Project Manual

February 21, 2025

STANTEC Project No. 21400 1184

FBISD BP031 Bush High School Renovations

02.21.2025

Fort Bend Independent

School District

Sugar Land, Texas

100% Construction Documents

Volume 1 of 2

Rear Cover

SECTION 00 01 01 – PROJECT TITLE PAGE

TITLE AND LOCATION OF THE WORK:

FBISD BP031 – Bush High School Renovations

NAME AND ADDRESS OF THE OWNER:

Fort Bend Independent School District
16431 Lexington Blvd.
Sugar Land, TX 77479

ARCHITECT AND CONSULTANTS:

STANTEC ARCHITECTURE
ARCHITECT
910 Louisiana Street, Suite #2600
Houston, Texas 77002
713-548-5700

DBR
MEP ENGINEER
9990 Richmond Avenue
South Building Suite 300
Houston, Texas 77042
713-914-0888

BAI, LLC
ACOUSTICAL CONSULTANT
4006 Speedway
Austin, Texas 78751
512-497-2222

S&G ENGINEERING CONSULTANTS
CIVIL ENGINEER
1796 Avenue D, Suite B
Katy, Texas 77493
832-437-7377

COMBS CONSULTING GROUP
LOW VOLTAGE CONSULTANT
1022 River Road #2
Boerne, Texas 78006
210-698-7887

MATRIX STRUCTURAL
STRUCTURAL ENGINEER
5177 Richmond Avenue, Suite 670
Houston, Texas 77056
713-333-0102

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
LIST OF DRAWINGS
CONTRACT DOCUMENTS

DOCUMENT 00 01 10 – MASTER TABLE OF CONTENTS

VOLUME 1 of 2

Note: This Master Table of Contents includes **all** specification sections for the Project regardless of origin. Sections marked by asterisk (*****) below are provided by consultants to the Architect or Owner and are not covered by the Architect's seal.

Refer to attached supporting Tables of Contents to identify Consultant responsible for a particular section.

DIVISION 00 – OWNER PROCUREMENT AND CONTRACTING REQUIREMENTS
Bidding Requirements and Contract Forms for Competitive Sealed Proposals (CSP)

02.21.2025

DIVISION 01 - GENERAL REQUIREMENTS

VOLUME 2 of 2

02.21.2025

DIVISIONS 29 & 30 - Not Used

DIVISION 31 – EARTHWORK: Reference Project Drawings for Civil Specifications

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

END OF VOLUME 2

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

02/21/2025

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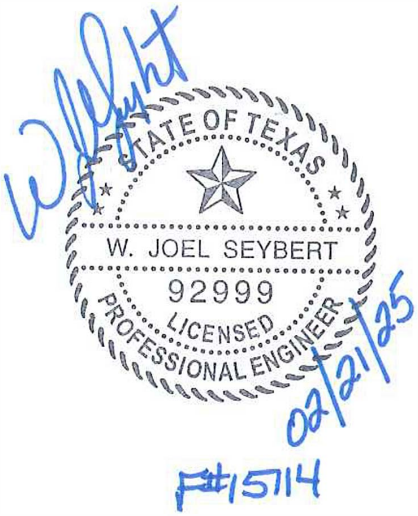
END OF STRUCTURAL TABLE OF CONTENTS

MEP TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)



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DIVISION 1 – GENERAL REQUIREMENTS

DIVISION 02 – EXISTING CONDITIONS

DIVISION 31 – EARTHWORK

DIVISION 32– EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DOCUMENT 00 01 14 – LANDSCAPE TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

2-21-25

DOCUMENT 00 01 20 - LIST OF DRAWINGS

Reference Drawing Sheet G000 (Drawing cover sheet) for listing of Construction Document drawings initially issued for Bidding. Final drawing list may be affected by Addenda.

END OF DOCUMENT

INSPIRE • EQUIP • IMAGINE

Fort Bend Independent School District

Competitive Sealed Proposal for

BP031 Bush HS Renovations
CSP 25-009AL

Package "A" Base Bid and all documents except Alternates & SBE documents.
DUE NO LATER THAN 2:00 PM Central Time (CST) April 1, 2025

Package "B" Alternates and Package "C" SBE
DUE NO LATER THAN
3:00 PM Central Time (CST) April 1, 2025

Bids will be opened and read aloud at 3:00 PM. Package "A" is still due at 2:00 PM (CST) and will be held by the district until the public opening at 3:00 PM (CST).
LATE PROPOSALS WILL NOT BE ACCEPTED

SUBMIT PROPOSAL PACKET THROUGH:

FBISD Bid Portal: https://fortbendisd.bonfirehub.com/portal/

DocuSigned by: 2/19/2025 | 8:23:56 CST
Signed by: 2/19/2025 | 1:41:27 CST
DS 2/18/2025 | 9:27:57 CST

BP031 Bush HS Renovations
CSP 25-009AL

BACKGROUND:

Fort Bend ISD (FBISD) is a K-12 public school district in Fort Bend County serving a student enrollment of over 80,000. The district currently consists of 83 campuses and multiple administrative sites. The intention of this Competitive Sealed Proposal (CSP) is to solicit proposals for a comprehensive renovation and expansion project at Bush High School (BP031). The estimated construction cost of work for this project is Twelve Million, Five Hundred Thousand Dollars. ($12,500,000.00).

PRE-PROPOSAL CONFERENCE:

A pre-proposal conference will be held on **Thursday, March 6, 2025 at 10:00 AM (CST)** meeting will be held virtually using Microsoft Teams. Attendance is highly recommended in order to have an understanding of the requirements of this CSP. For this pre-proposal meeting, persons with disabilities requiring special accommodations should contact: Antoinette Lewis at Antoinette.lewis1@fortbendisd.gov at least two (2) days before the conference. Any questions/clarifications that result from the visit should be submitted through the **Ask a Question** section in Bonfire. **Meeting Link: Join the meeting now**.

WALK SCHEDULE:

A pre-proposal walk is scheduled for **Thursday, March 6, 2025, 2:00 PM (CST)** at Geroge Bush Highschool (6707 FM 1464, Richmond, TX 77407). Attendance is highly recommended in order to have an understanding of existing site conditions and the project's scope of work.

SPECIAL NOTE:

Please be reminded that all Fort Bend ISD campuses and departments are tobacco, drug, and weapon-free facilities. Contractors are responsible for the conduct of their employees and adherence to Fort Bend ISD building policies.

QUESTIONS AND ANSWERS:

Any questions or needed clarifications shall be submitted through the **Ask a Question** section in Bonfire before the deadline for questions due date and time **Tuesday, March 18, 2025 10:00 AM (CST).** Questions received by the deadline and corresponding answers will be included in an Addendum and posted in FBISD e-bidding portal Bonfire.

All Fort Bend ISD procurement solicitations and addendums can be accessed on Bonfire at https://fortbendisd.bonfirehub.com PLEASE **NOTE THAT IT IS THE RESPONSIBILITY OF THE PROPOSERS TO CHECK FOR ANY ADDENDUMS ON THE BONFIRE ELECTRONIC BIDDING SYSTEM PRIOR TO SUBMITTING A PROPOSAL.**

GENERAL TERMS, CONDITIONS, AND REQUIREMENTS FOR SOLICITATIONS:

This solicitation shall be governed by the documents incorporated herein as well as the Fort Bend ISD General Provisions for Purchasing Solicitations are incorporated herein. A copy may be obtained at general-provisions-for-purchasing-solicitations-and-contracts.pdf or by contacting the Fort Bend ISD Buyer listed on the coversheet.

Copy of the Construction contract, the A101 and A 201, are incorporated herein.
Texas Education Code 44.031(a)(5); Texas Government Code Chapter 2269
Purchasing and Acquisition, FBISD Policy CH (Legal)
Purchasing and Acquisition, FBISD Policy CH (Local)
Facilities and Construction, FBISD Policy CV (Legal)
Facilities and Construction, FBISD Policy CV (Local)

Proposers are required to respond to all requests identified in this CSP and indicate their acceptance or objection to the terms of the CSP, the General Provisions, and the terms of the Agreement for Construction Services. Any exceptions to the terms and conditions in the CSP, the General Provisions, or the Agreement for Construction Services must be clearly indicated in the Proposer's submitted proposal. Each Proposer, by submitting its proposal, represents that the Proposer has read, understands, and agrees with the CSP, the General Provisions, and the Agreement for Construction Services, excluding any exception specifically made by Proposer in its proposal.

VENDOR COMMUNICATION:

Please remember that during the selection process, FBISD desires to avoid even the perception of preferential treatment.

Therefore:

- Other than the designated contact person listed in this CSP: All Communication regarding this CSP with District employees, staff, consultants, Architects/Engineers or Board members is strictly forbidden and may result in disqualification.

- All requests for clarification must be provided in writing through the e-bidding portal **Ask a Question** section to the designated contact person.

- The answer to the request for clarification and all other communication, clarification, or questions regarding this CSP will be issued in writing to all participating firms through the e-bidding portal (Bonfire).

Scope of Work

FBISD is seeking a contractor to provide a turnkey solution for a comprehensive renovation and expansion project at Bush High School (BP031). This project scope of work includes renovation to the existing auditorium and support spaces, minor renovations to existing fine arts suite, campus wide MEP upgrades, sitework renovations, as well as the construction of a new fine arts building addition.

Contractor Experience and References

Contractor must provide customer references letter in order to receive points in the evaluation criteria section. Contractor must provide proof of pertinent experience (previous educational experience) along with documentation of successful completion of projects completed within the last 3 to 5 years with a minimum construction cost for interior High School's Fine Arts Renovations and Expansion at approximately $8,000,000.

For information and questions regarding this CSP process, please contact:

Senior Buyer: Antoinette Lewis
Email: Antoinette.lewis1@fortbendisd.gov

EVALUATION CRITERIA:

Proposals shall be evaluated using the evaluation criteria listed below, and the scope of work will be awarded by Project. Based on scope of work, FBISD reserves the right to award the Project to the top ranked contractor in the manner that provides the best value to the district based on price and other evaluation criteria.

	Evaluation Criteria (Government Code 2269)	Point System
1	**The price; Section 2269.055.a (1)** Total Proposed Pricing - Provides thoroughly developed, competitive pricing using the tables in Pricing Delivery information section of the CSP	40 points
2	**Offeror's experience and reputation; Section 2269.055.a (2)** Provides evidence of your experience in planning, staging and delivery of recent projects of similar scope and scale (14 pts)	19 points
	Past experience with FBISD and other school districts Provides a summary of nature of work, on time delivery and quality of work contracted with FBISD and/or other school districts and FBISD's assessment of the presented summary. (5 pts)	
3	**Quality of the offeror's goods or services; Section 2269.055.a (3)** Contractor's products should be new and be of the highest quality with an option to substitute for a company branded item of equivalent quality. (14pts)	21 points
	Quality of contractor's response in the proposal Effectively responds and processes all request for information and documentation included in this CSP (2pts)	
	Project Plan and schedule (5pts)	
4	**Utilization of historically underutilized businesses; Section 2269.055.a (4)**	N/A
5	**Offeror's safety record; Section 2269.055.a (5)** Provides a summary of Experience Modification Rate (EMR) for the last three years, as well as a summary of your company's safety policies and procedures	5 points
6	**Offeror's proposed personnel; Section 2269.055.a (6)** Proposed Personnel, personnel directly assigned to work on this project	5 points
7	**Offeror's financial capability appropriate to the size and scope of the project; Section 2269.055.a (7)** Provide proof of Insurance, financial stability and Letter of Surety from Bonding Company	5 points
8	**SBE Commitment; CV (Local) 2017.04**	5 points
	TOTAL	100

TIME TABLE:

FBISD anticipates following the time table listed below for this proposal: **The time table is only an estimate and actual dates may vary.**

Item	Activity	Date
1.	Job starts to advertise (1st run)	2/25/2025
2.	Job advertises (2nd run)	3/4/2025
3.	Pre-Proposal Conference 10:00 AM (CST)	3/6/2025
4.	Pre-Proposal Walk 2:00 PM (CST)	3/6/2025
5.	Final Questions due 10:00 AM (CST)	3/18/2025
6a.	Proposal Package "A" Due **2:00 PM (CST)** Base Bid and all documents, except Alternates and SBE documents Click or tap here to enter text.	4/1/2025
6b.	Proposal Package "B" Due **3:00 PM (CST) Alternates only**	4/1/2025
6c.	Proposal Package "C" Due **3:00 PM (CST) SBE documents only**	4/1/2025
7.	Presentation to Board of Trustees for contract award (Tentative, subject to change)	06/2025
8.	Tabulations and awards posted to https://fortbendisd.bonfirehub.com/portal/?tab=pastOpportunities	07/2025
9.	Substantial Completion of the Work	08/2027

SUBMISSION DEADLINE:

Fort Bend ISD will accept proposals submitted electronically through Bonfire e-bidding portal until **Tuesday, April 1, 2025** at **2:00 PM CST**. https://fortbendisd.bonfirehub.com.

Proposals must be uploaded and finalized prior to the closing date and time. Proposals received after the opening will not be accepted. Public bid opening will be conducted via Microsoft Teams **Tuesday, April 1, 2025**

Meeting Link: Join the meeting now.

It is recommended that once you have completed your final submission and received a notice status of "Submission Complete" from Bonfire, you access your account again and review the documents to verify that the correct content has been provided.

Once the close date has passed, you will be unable to submit an opportunity or make changes to anyof the submitted documents. **HARD-COPY PAPER FAXED OR E-MAILED SUBMISSIONS WILL NOT BE ACCEPTED.** Only responses properly submitted to FBISD Bonfire Purchasing Portal will be considered.

Prevailing Wage Rate
Determination Information

The following information is from Chapter 2258 Texas Government Code:

Sec. 2258.021. Right to be Paid Prevailing Wage Rates.

(a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
    (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
    (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
(b) Subsection (a) does not apply to maintenance work.
(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

Sec. 2258.023. Prevailing Wage Rates to be paid by Contractor and Subcontractor; Penalty.

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.
(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.
(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

Sec. 2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

(1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
(2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

Prevailing Wage Rates – School Construction Trades

June 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	$21.13
BRICKLAYER; MASON	$25.32
CARPENTER; CASEWORKER	$23.38
CARPET LAYER; FLOOR INSTALLER	$25.12
CONCRETE FINISHER	$23.40
DATA COMM/TELE COMM	$23.50
DRYWALL INSTALLER; CEILING INSTALLER	$26.65
ELECTRICIAN	$25.93
ELEVATOR MECHANIC	$28.80
FIREPROOFING INSTALLER	$22.25
GLAZIER	$22.30
HEAVY EQUIPMENT OPERATOR	$22.40
INSULATOR	$20.50
IRONWORKER	$25.50
LABORER, HELPER	$16.71
LATHERER; PLASTERER	$23.25
LIGHT EQUIPMENT OPERATOR	$20.50
METAL BUILDING ASSEMBLER	$21.10
MILLWRIGHT	$33.63
PAINTER; WALL COVERING INSTALLER	$19.60
PIPEFITTER	$26.97
PLUMBER	$26.71
ROOFER	$20.50
SHEET METAL WORKER	$19.90
SPRINKLER FITTER	$26.13
STEEL ERECTOR	$23.25
TERRAZZO WORKER	$23.50
TILE SETTER	$19.58
WATERPROOFER; CAULKER	$19.88

This document was developed by PBK Architects, Inc., in strict accordance with Chapter 2258 of the Texas Government Code.

Prevailing Wage Rates

Worker Classification Definition Sheet

CLASSIFICATION	DEFINITION
ASBESTOS WORKER	Worker who removes and disposes of asbestos materials.
BRICKLAYER; MASON	Craftsman who works with masonry products, stone, brick, block, or any material substituting those materials and accessories.
CARPENTER; CASEWORKER	Worker who build wood structures or structures of any material which has replaces wood. Includes rough and finish carpentry, hardware and trim.
CARPET LAYER; FLOOR INSTALLER	Worker who installs carpets and/or floor coverings, vinyl tile.
CONCRETE FINISHER	Worker who floats, trowels, and finishes concrete.
DATA COMM/TELE COMM	Worker who installs data/telephone and television cable and associate equipment and accessories.
DRYWALL; CEILING INSTALLER	Worker who installs metal framed walls and ceiling, drywall coverings, ceiling grids, and ceilings.
ELECTRICIAN	Skilled craftsman who installs or repairs electrical wiring and devices. Includes fire alarm systems and HVAC electrical controls.
ELEVATOR MECHANIC	Craftsman skilled in the installation and maintenance of elevators.
FIREPROOFING INSTALLER	Worker who sprays or applies fire proofing materials.
GLAZIER	Worker who installs glass, glazing, and glass framing.
HEAVY EQUIPMENT OPERATOR	Includes but not limited to: all CAT tractors, all derrick-powered, all power operated cranes, back-hoes, back-fillers, power operated shovels, winch trucks, and all trenching machines.
INSULATOR	Worker who applies, sprays, or installs insulation.
IRONWORKER	Skilled craftsman who erects structural steel framing and installs structural concrete Rebar
LABORER, HELPER	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials or tools, hauling, digging, clean up.
LATHERER; PLASTERER	Worker who installs metal framing and lath. Worker who applies plaster to lathing and installs associated accessories.
LIGHT EQUIPMENT OPERATOR	Includes but not limited to, air compressors, truck crane drivers, flex planes, building elevators, form graders, concrete mixers less than 14cf), conveyers.
METAL BUILDING ASSEMBLER	Worker who assembles pre-made metal buildings.
MILLWRIGHT	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts, and align pumps.
PAINTER; WALL COVERING INSTALLER	Worker who prepares wall surfaces and applies paint and/or coverings, tape, and bedding.
PIPEFITTER	Trained worker who installs piping systems, chilled water piping and hot water (boiler) piping, pneumatic tubing controls, chillers, boilers, and associated mechanical equipment.
PLUMBER	Skilled craftsman who installs domestic hot and cold-water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
ROOFER	Worker who installs roofing materials, Bitumen (asphalt and coal tar) felts, flashings, all types of roofing membranes, and associated products.
SHEET METAL WORKER	Worker who installs sheet metal products, Roof metal, flashings and curbs, ductwork, mechanical equipment, and associated metals.
SPRINKLER FITTER	Worker who installs fire sprinklers systems and fire protectant equipment.
STEEL ERECTOR	Worker who erects and dismantles structural steel frames of buildings and other structures.

TERRAZZO WORKER	Craftsman who places and finishes Terrazzo.
TILE SETTER	Worker who prepares wall and/or floor surfaces and applies ceramic tiles to these surfaces.
WATERPROOFER; CAULKER	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membranes, and liquid membranes, sprayed, rolled or brushed.

INSTRUCTIONS TO BIDDERS

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Instructions to Bidders:

Bidders Communication

Please remember that during the selection process, we desire to avoid even the perception of preferential treatment.

Therefore:

- **Other than the designated contact person listed in this CSP: All Communication regarding this CSP with district employees, staff, consultants (Architects/Engineers), or Board members is strictly forbidden and may result in disqualification.**
- **All requests for clarification must be provided in writing to the designated person.**
- **The answer to the request for clarification and all other communication, clarification, or questions regarding this CSP will be issued in writing by addenda to all participants.**

The district electronic bidding portal https://fortbendisd.bonfirehub.com/portal/ is the source for all CSP documents and direction; Addenda, Proposal packet, Drawings and specifications.

- **VERY IMPORTANT**
  - **Communication regarding this CSP with district employees, staff, consultants (Architects/Engineers), or Board members is strictly forbidden and may result in disqualification. (Other than the designated contact person listed in this CSP.)**

CSP Process for Successful Bidders

1.0 GENERAL INFORMATION

1.1 The Proposer will furnish and pay for a bid bond in the form of a bid bond, postal money order, certified check or cashier's check in the amount of five percent (5%) of the total greatest amount, bid including any applicable alternates, in accordance with Section 6.0.

1.2 If awarded, the Bidder shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount in accordance with Section 7.0. Include this cost in your bid.

1.3 Bidder shall carry and keep in full force for the duration of the Project, insurance coverage for builder's risk, workmen's compensation, comprehensive general liability, and automobile liability as required by the General Provisions and/or Supplementary General Conditions of the Specifications, as outlined in Section 8.0.

1.4 The Bidder will assign a competent full-time superintendent, to the project, and that superintendent shall be maintained on the project for the duration of the project, subject only to his continuous employment.

1.5 During this process all communication regarding this CSP with district employees, staff, consultants (Architects/Engineers), or Board members is strictly forbidden and may result in disqualification. (Other than the designated contact person listed in this CSP)

1.6 In accordance with Texas Government Code Section 2269, The Board of Trustees, as appropriate, has delegated its authority under this subchapter regarding an action authorized or required by this subchapter to be taken by a school district to the Ft Bend ISD Superintendent. In procuring the construction services, the Board of Trustees has delegated the ranking, selection, or evaluation of bids.

1.7 In determining the award of contract and in accordance with Texas Government Code Section 2269, the district may consider: the price, the offeror's experience and reputation, the quality of the offeror's goods or services, the impact on the ability of the governmental entity to comply with rules relating to historically underutilized businesses, the offeror's safety record, the offeror's proposed personnel, whether the offeror's financial capability is appropriate to the size and scope of the project; and any other relevant factor specifically listed in the request for bids, proposals, or qualifications.

1.8 Evaluation of the proposed substitutes/deviations does not constitute Owner's acceptance of the substitutes/deviations but can be considered during negotiations.

1.9 In accordance with Texas Government Code Section 2269, The district shall select the offeror that submits the proposal that offers the best value for the governmental entity based on:

- the selection criteria in the request for proposal and the weighted value for those criteria in the request for proposal; and
- its ranking evaluation.

1.10 In accordance with Texas Government Code Section 2269 the Board of Trustees has determined the method that provided the best value for the district is the Competitive Sealed Proposal method.

1.11 In accordance with Texas Government Code Section 2269 the district shall publish in the request for proposals or qualifications the criteria that will be used to evaluate the offerors, and the applicable weighted value for each criterion.

1.12 In accordance with Texas Government Code Section 2269 the district shall document the basis of its selection and shall make the evaluations public not later than the seventh day after the date the contract is awarded.

1.13 In accordance with Texas Government Code Section 2269, the district will receive, publicly open, and read aloud the names of the offerors and their bids.

1.14 In accordance with Texas Government Code Section 2269, the district will evaluate and rank each proposal submitted no later than 45 days after the opening.

1.15 In accordance with Texas Government Code Section 2269, The district shall first attempt to negotiate a contract with the selected offeror. The district and its architect or engineer may discuss with the selected offeror options for a scope or time modification and any price change associated with the modification. If the district is unable to negotiate a satisfactory contract with the selected offeror, the district shall, formally and in writing, end negotiations with that offeror and proceed to the next offeror in the order of the selection ranking until a contract is reached or all proposals are rejected.

2.0 COMPETITIVE SEALED BID DOCUMENTS PRE-BID

2.1 A Pre-proposal conference will be held as required. Representatives of the Owner, and design team will be present at this meeting. All Bidders are encouraged to attend.

3.0 COMPETITIVE SEALED PROPOSAL PACKET

3.1 Bids will be received only on the Owner's "Bid Form" for the work as indicated by the proposal documents, filled in, and submitted in Bonfire as listed below. Bids will be received at no other place.

3.2 Bonfire Submittal Organization

SUBMIT PROPOSAL PACKET THROUGH:
https://fortbendisd.bonfirehub.com/portal/

Submission Package "A"	
CSP Cover Page Addenda Acknowledgment Section Bid Bond Base Bid Form	**DUE on Bid Day at 2:00 PM**
All required Forms	**DUE on Bid Day at 2:00 PM**
Financial Section	**DUE on Bid Day at 2:00 PM**
Safety Manual	**DUE on Bid Day at 2:00 PM**
Submission Package "B"	**Submit Through Bonfire E-Bidding Portal Package "B" DUE same day at 3:00PM**
Alternate Pricing	
Submission Package "C"	
SBEP commitment Submission	**Submit Through Bonfire E-Bidding Portal Package "C" DUE same day at 3:00PM**

4.0 INTERPRETATION OF COMPETITIVE SEALED PROPOSAL DOCUMENTS

4.1 Bidders and sub-Bidders requiring "CSP" clarification or interpretation of the CSP documents shall make the request in written form, by email to FBISD buyer listed in the CSP documents.

4.2 Any interpretation, correction or change of the CSP documents will be made by Addendum and posted to our website. Interpretations, corrections or changes of the CSP documents made in any other manner will not be binding.

5.0 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

5.1 Substitutions of Goods. The materials, products and equipment described in the CSP documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better See (Part V, Section 3.9 of General Provisions)

5.2 If the Owner/Engineer approves any proposed substitution prior to receipt of bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

5.3 No deviations are allowed in the base bid or base bid adjustment. Any deviation from the Base Bid shall be submitted as Alternate No. 2 on the Deviations Form.

5.4 Evaluation of the proposed substitutes/deviations does not constitute Owner's acceptance of the substitutes/deviations but can be considered during negotiations.

5.5 Price scores will be based on the base bid plus/minus the base bid adjustment which must be in adherence to all plans and specifications published.

6.0 BID BOND/BID GUARANTEE

6.1 Bid bonds are required for bids in excess of $25,000. A Bid bond will be submitted in the form of a Bid bond, postal money order, certified check or cashier's check in an amount not less than **five percent (5%) of the total greatest amount bid, including any applicable alternates,** payable without recourse to Fort Bend Independent School District. Failure to furnish a bid guarantee in the proper form and amount by the time set for opening may be cause for rejection of the bid. If the successful Bidder, upon acceptance of his bid by the District within the period specified therein for acceptance, fails to execute such further contractual documents, if any, and give such bond(s) (i.e., performance bonds, payment bonds, delivery, etc.) as may be required within the time specified (ten [10] calendar days if no period is specified) after receipt of the forms by him, then he shall be liable for any cost of procuring the work which exceeds the amount of his bid, and the bid guarantee shall be available toward offsetting such difference.

7.0 PERFORMANCE BOND AND PAYMENT BOND

7.1 Performance bonds are required for bids in excess of $100,000. Payment Bonds are required for bids in excess of $25,000 Gov't Code 2253.021

7.2 .When a performance or payment bond is required, the amounts shall be for 100% of the contract amount (including contingency). Any required bond(s) must be filed with the District within 10 days from the date of the Notice Of Award.

7.3 The only forms of surety acceptable as a performance or payment bond are: Cashier's Check, Certified Check, or a Surety or Blanket Bond from a company chartered or authorized to do business in Texas. Bonds completed (signed) by an out-of-Texas surety require a counter signature by a Texas resident agent of a company chartered or authorized to do business in Texas.

7.4 Bonds and other forms of surety must be made payable to Fort Bend Independent School District.

7.5 Bonds in excess of $100,000 must be from a surety that holds a Certificate of Authority from the United States Department of Treasury or have reinsurance for liability in excess of $100,000 from a United States Treasury listed reinsurer.

7.6 Payment and Performance Bonds must be in accordance with Texas Government Code 2253.

8.0 INSURANCE

Exhibit A

FORT BEND I.S.D. CONSTRUCTION BOND & INSURANCE REQUIREMENTS

It is suggested that this Exhibit be provided to the Contractor's insurance provider.

Contractor shall not commence work until all required bonds and insurance coverages have been obtained and such insurance has been reviewed and accepted by the District. Certificates of Insurance on the current ACORD form shall be issued to the District showing all required insurance coverages.

Bonds Required

Construction, installation and service contracts (including repair and alteration) exceeding $100,000 requires that a 100% Performance Bond be furnished by the successful bidder (contractor). Contracts exceeding $25,000 require that a 100% Payment Bond be furnished by the successful bidder (contractor). All such bids must include a 5% Bid Bond.

Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of at least A- X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570). The contractor shall be responsible for obtaining bonds and shall absorb any and all costs of such Bonds.

Insurance Required	Limit Required
Automobile Liability insurance covering Any Auto	$1,000,000 Combined Single Limit
Comprehensive (Commercial) General Liability insurance including Products, Completed Operations, Independent Contractors, Broad Form Property Damage, Pollution and Blanket Contractual Liability coverages. XCU exclusions to be removed when underground work is performed.	$1,000,000 Occurrence $2,000,000 Aggregate $1,000,000 Personal Injury $ 500,000 Fire Damage $ 5,000 Medical Payments Per Project Aggregate (CG 70 49) Evidence of coverage must be shown on certificates of insurance.
Professional Errors & Omissions Liability insurance may be required from all contractors and licensed or certified as professionals; e.g., engineers, architects, insurance agents, physicians, attorneys, banks, financial consultants, etc.	One time project amount; $1,000,000 Occurrence & Aggregate minimum, $5,000,000 Maximum Limit Retroactive Date preceding date of contract must be shown Extended Reporting Period three years past completion of contract
Workers Compensation insurance with limits to comply with the requirements of the Texas Worker Compensation Act Employers Liability insurance	Statutory Limits $1,000,000
Umbrella or Excess Liability insurance (excess of primary General Liability, Automobile Liability and WC Coverage B) Applicable to minimum contract amounts **of $100,000**	100% of Contract Amount up to a maximum of $25,000,000. For construction contracts in excess of $25,000,000 higher limits may be required.

Limits for primary policies may differ from those shown when Umbrella or Excess Liability insurance is provided.

10.19.16BC Morrison

All Risk Builders Risk Property Insurance shall be required for all construction contracts when property of the owner is at risk or in the care, custody and control of the Contractor. Builders Risk insurance shall be required for all construction contracts requiring a bond. All Property insurance shall include coverage against the perils of Flood and Earthquake. (Installation Floater may be substituted when contract involves installation only.)	Contract Limit or Replacement Cost Value of Scope of Work whichever is greater Permission to Occupy granted Deductible: 1% of contract, $50,000 maximum, unless otherwise approved by the Owner.

Insurance Conditions

All insurance coverages shall be issued on an Occurrence basis (except Professional Liability) by companies acceptable to District and licensed to do business in the State of Texas by the Texas Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".

All certificates must include:

1. The location or description and the bid number, CSP number or Purchase Order number
2. A 30 day notice of cancellation of any non-renewal, cancellation or material change to any of the policies
3. "Additional Insured" on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District.
4. A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies.
5. In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the District as Additional Insured, and (b) showing waivers of subrogation in favor of the District: CG2010, CG2037, CG2404, CA0070, CA0032, WC0003 or their equivalents.

All insurance must be maintained for one year following substantial completion with Certificates of Insurance provided.

Contractor shall be responsible for payment of all deductibles; the District shall approve the deductibles selected.

If any policy has aggregate limits, a statement of claims against the aggregate limits is required.

The District reserves the right to review the insurance requirements during the effective period of any contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.

FORT BEND Independent School District
C/o Director – Design & Construction Department
2323 Texas Parkway
Missouri City, TX 77489

9.0 EVALUATION CRITERIA AND RELATIVE WEIGHTS

In accordance with Government Code Section 2269.056 the applicable weighted value for each criterion is published in the front pages of the CSP package.

9.1 Proposal Delivery and Organization

Offeror is to organize the Proposal in the following format:

1) To comply with Government code chapter 2269.059 your submittal must be sealed before delivery. Provide the requirements listed below in the order provided.

1.1 Provide with the Proposal Base Bid Form (Submit in Bonfire Proposal Bid Form Section):

- Addenda Acknowledgment Sheet
- Bid Bond
- Proposal Base Bid Form

1.2 Provide the district and statute required forms in Bonfire Under Required Forms Section:

- No Response Form(Optional)
- Contractor Informational Form (Required)
- Contractor Questionnaire (Required)
- Bonding Capacity Certification Letter (Required)
- Proposal Submission Form (Required)
- Non-Collusion Certification (Required)
- Certificate of Residency (Required)
- Affidavit of Non-Discriminatory Employment (Required)
- Contractor Certification (Required)
- Felony Conviction Notification (Required)
- Vendor Debarment Statement (Required)
- Conflict of Interest Questionnaire (Required)
- Certification regarding Lobbying (Required)
- Confidential Copyrighted Information (Required)
- Owner(s) Name of Business (Required)
- Delinquent Taxpayers (Required)
- Identification Number & Certification (Required)
- Fort Bend ISD Contractor and Subcontractor Participation Form (Required)
- Certificate of Interested Parties Form 1295 (Required)
- Forms Certification (Required)
- Per Govt. Code 2270.002, provide written verification that the company does not boycott Israel and will not during the term of the contract.

1.3 For Proposals Formal Submission: Provide in Each Section in Bonfire as listed below. Provide information that details the evaluation response for each of the following criteria. Must be in the location specified in Bonfire.

- Section ONE (**Offeror's Experience and Reputation**)

- Section TWO (**Quality of the Offeror's Goods and Services**)
- Section THREE (**Offeror's Proposed Personnel**)
- Section FOUR (**Other Relevant Factor- Plan and Schedule**)

1.5 **Financial Section** (Submit in Bonfire Offeror's Financial Section) "**Financial stability and bonding capacity**" (all financial information provided in Bonfire is confidential)

1.6 **Safety plan and safety record**" (Submit in Bonfire Safety Manual Section)

1.7 **Alternate Bid Proposal Submission (**Submit in Bonfire Package "B" Section)
- Alternate Bid Proposal Form
- Deviation Form (if Applicable)

1.8 **SBEP commitment**" submission (Submit in Bonfire Package C Section)

9.2 Relative Weights

To determine the best value bidder, the Owner will evaluate the responses and information submitted on the Bid Form, Contractor's Information Statement Form and other bid documents in regards to the following criteria:

1) "The Price"

Texas Government Code 2269.055.a (1) The price.

1.1) Proposed construction contract price (base price plus alternates as defined on the bid form). Contract price shall include both base price and accepted alternate price as defined on the bid form. The final weighting distribution will be a calculated percentage.

1.2) No deviations are allowed in the base bid or base bid adjustment. Any deviation from the Base Bid shall be submitted as Alternate No. 2 on the Deviations Form.

1.3) Evaluation of the proposed substitutes/deviations does not constitute Owner's acceptance of the substitutes/deviations but can be considered during negotiations.

1.4) Price scores will be based on the base bid +/- the base bid adjustment which must be in adherence to all plans and specifications published.

2) "FORMAL SUBMISSION SECTION ONE – "Offeror's Experience and Reputation"

Texas Government Code 2269.055.a (2) The offeror's experience and reputation.

2.1) Provide three (3) letters of reference for projects completed in the past **one (1) year** from major suppliers and/or sub-contractors which specifically address the bidder's history of paying sub-contractors and material providers on time.

2.2) List current or pastFBISD projects completed within the past **five (5) years** of similar scope and size.

2.3) List current or past projects with other school district completed within the **past five (5) years** of similar scope and size.

2.4) Letters of reference from Director of Facilities/Operations/Maintenance & from campus on housekeeping and cleanliness from FBISD and/or other school district

2.5) The district staff will contact the Owners, identified in the list of current of past K-12 projects or Non K-12 projects completed within the **past five (5) years** of similar scope and size. References

may be conducted by FBISD staff to ascertain the following:

- The quality of the work provided by bidder.
- The bidder's history of providing warranty documents.
- The bidder's history of timeliness in completing warranty work.
- The bidder's history of staying on schedule.
- The bidder's cooperative attitude when working with the owner and its architect in resolving construction issues.
- The bidder's history of providing detailed documentation and a fair assessment of change order pricing.
- The bidder's history of repeat business with owner(s).

2.6) Provide a detail of your history of on-time project completion. The district may verify the bidder's history based on references contacted by FBISD Administrative staff.

2.7) List all claims, judgments, arbitration proceedings or suits pending or outstanding against your company or its officers. Summarize the nature of the claims.

3) "FORMAL SUBMISSION SECTION TWO – Quality of the Offeror's Goods and Services"

Texas Government Code 2269.055.a (3) The offeror's experience and reputation

3.1) Include in the proposal; your firms' philosophy on construction management, your sub-contractor selection process, details of managing conflicts, staffing issues, subcontractor disputes. Include your plan for operating on an occupied school site. Include your system for coordination with local jurisdictions, your methodology for quality control. Provide a statement in your work flow plan that indicates scheduling and timing of site meeting, coordination with owners, documentation, and your firm's unique ability to satisfy the client. Include a project schedule/timeline with project specific parameters or limitations (e.g. evening, summer, holiday work).

3.2) Provide evidence of sufficient resources necessary to manage, staff and successfully perform the Work.

3.3) The bidder's history of on-time project success

3.4) Provide a sample quality management plan that would include your role in substantiating conformance with the contract documents. Include in the plan your performance history for: quality assurance/quality control, preconference processes, process for documenting and correcting nonconforming work, as well as the process and staff that would oversee this plan.

3.5) Provide cost saving ideas and associated cost.

3.6) Provide details of firms PMCS capabilities, include familiarity with major software packages, CAD coordination, and electronic filling, submissions, and transmittals.

4) Utilization of historically underutilized businesses

Texas Government Code 2269.055.a (4). Not Applicable

5) Offeror's Safety Record – "Safety plan and safety record"

Texas Government Code 2269.055.a (5) The offeror's safety record.

5.1 Provide your company's safety program manual. (see submission process in section A above)

5.2 Provide OSHA No. 300 Log information for the past three (3) years regarding following points:

- Number of injuries and illnesses
- Number of lost time accidents
- Number of recordable cases
- Number of fatalities
- Number of employee direct hire fixed hours worked (round to 1,000's)

5.3 Provide your company's safety orientation program for new employees.

5.4 State the frequency and provide evident of ongoing safety inspections as implemented in current projects.

5.5 Provide your company's drug/alcohol prevention policy.

6) "FORMAL SUBMISSION SECTION THREE – "Offeror's Proposed Personnel"

Texas Government Code 2269.055.a (6) The offeror's proposed personnel – Resumes, experience, certifications, past specific experience with similar scope.

6.1 List individuals and provide detailed resumes of the positions for Project Manager, Assistant Project Manager, Project Superintendent, Assistant Project Superintendent and MEP Quality Control Specialist who will be assigned for the entire duration of the Project. Resumes should address the following points for each of the positions mentioned above.

- Amount of time assigned to project;
- Years of experience;
- Current project assignment and availability for this project
- Relevant K-12 experience;
- Certifications
- Include project available dates for key staff

7) "Offeror's Financial Capability Appropriate to the Size and scope of the Project"

Texas Government Code 2269.055.a (7) whether the offeror's financial capability is appropriate to the size and scope of the project

7.1 Submit Bond on FBISD mandated form.

7.2 Provide your company's single limit coverage.

7.3 Provide your company's aggregate/total available limit of coverage.

7.4 List your surety company and address following points.

- Years your company has had a business relationship with surety;
- AM Best Rating;
- Identify if surety company is registered in the State of Texas.

7.5 List projects your company has in progress. For each project listed address the following points.

- Name of project;
- Owner's contact person and phone number;
- Architect, Architect's contact person and phone number;
- Contract amount;
- Percent complete;
- Scheduled completion date;
- List total worth of work in progress and under contract.

7.6 Provide a recent financial statement for the organization that is proposing.

7.7 The financial statement should be attested to by a CPA, an Audit is preferred, a Review is acceptable, or a Compilation at a minimum.

AUDIT

- provides the highest level of assurance on an organization's financial statement

REVIEW

- provides limited assurance on an organization's financial statements

COMPILATION

- provides no assurance on an organization's financial statement

7.8 The Financial Statement must address the following points:

- Your organization's latest balance and income statement showing current assets, net fixed assets, other assets, current liabilities and other liabilities;
- Indicate name and address of firm preparing financial statement, and date thereof;
- If the financial statement is not for the identical organization submitting offer, explain the relationship and financial responsibility of the organization whose financial statement is provided (parent, subsidiary, etc.)

7.9 If available, please list your company's Dunn & Bradstreet risk rating.

8) "SUBMIT IN BONFIRE PACKAGE "C" – "SBEP commitment"

Texas Government Code 2269.055.b (2) Any other relevant factor specifically listed in the request for bids or proposals.

8.0 Provide your Small Business Enterprise Program Proposal packet.

8.1 Small Business Enterprise Program

8.1.1 Owner has adopted a Small Business Enterprise Program to provide increased business opportunities for locally certified small businesses to competitively participate in contracting and procurement within FBISD. See FBISD Board Policy CV(Local), and the FBISD Small Business Enterprise Program.

8.1.2 Small Business Practices:

8.1.2.1 Describe your previous experience, involvement and approach in working with certified Small Business firms; including level of effort, division of duties and providing opinions. Provide a statement detailing small business participation commitment.

8.1.2.2 For this Project FBISD has a small business participation goal of Twenty-Five Percent (25%).

8.1.2.3 At a minimum, your response must include: (a) Firm's commitment to meeting the small business participation goal for the project (b) a description of previous projects where your firm has successfully subcontracted work to small businesses including the percentage (%) of work subcontracted to these firms under each project; (c) a narrative outlining your overall approach to subcontracting and how you will solicit small businesses for participation as part of this Project; and (d) indicate what challenges you anticipate in attaining FBISD's goal.

8.1.2.4 Describe your company's process for the selection of subcontractors in accordance with the statutory procedures required for the solicitation of subcontractors under a Construction Manager-at-Risk delivery method, including your process for evaluating subcontractors' performance while also incorporating a Small Business Development Program.

8.1.2.5 Provide a reference list of all customers noted in Past Performance References that included a Small Business or similar program where you have performed work similar to the type of work described in this CSP. Provide the contact person and the representative who served as the Small Business Development liaison, telephone number and email address.

8.1.2.6 If, in the opinion of the Evaluation Committee, the Proposal Response completely meets the stated small business participation goals, the total amount of eligible points will be awarded for small business participation, as indicated below.

Proposed SBE Subcontracting	Available Points
Less than 5%	0
5% - 9%	1
10% - 14%	2
15% - 19%	3
20% - 24%	4
25% or more	5

8.1.3 Points shall be awarded in accordance with the Proposal Response based on the prime vendor's commitment to small business subcontracting stated in the solicitation document and the published point distribution sliding scale.

8.1.4 If the proposer itself is a certified Small Business who plans to self-perform work, the value of such self-performed work shall be included in calculating the eligible points for small business participation to the Small Business Proposer, in addition to the value of work subcontracted to another small business.

8.1.5 If the proposer itself is a not a certified Small Business, but has join-ventured with another certified Small Business, only the value of work to be self-performed by the certified Small Business Prime contractor will be included in calculating the eligible points for small business

participation to the Small Business Proposer/joint venture, in addition to the value of work subcontracted to another small business.

8.1.6 Once selected, all prime construction contractors ("Contractor") working with FBISD on SBEP eligible construction projects shall be required to submit the Fort Bend ISD Subcontractor Progress Assessment Form with each application for payment, requesting payment be made for Work performed by a subcontractor that qualifies as a "small business" under FBISD Board Policy CV (Local). The Contractor shall also ensure that, once Contractor makes the applicable payment to the Small Business Subcontractor, the Subcontractor completes the Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form in its entirety. Contractor agrees to submit the completed copies to Owner with the next application for payment. The completed Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form must be received by the Owner before any further payment will be made to Contractor for any Work performed.

8.1.7 Include with your submission the SBEP Participation Report

8.1.8 Include with your submission the Supplier Diversity Questionnaire

9.0 Award of the Contract

1.1 The Bidder to whom the award is made will be promptly notified. If a Bidder (a) withdraws his bid within 45 days after the date of time fixed for the opening of bids in the Request for Competitive Sealed Bids, or (b) fails or refuses to execute the Agreement, or other required forms within ten (10) calendar days after the same are presented to him for signature, or (c) fails or refuses to furnish properly executed Performance Bond and Certification of Required Insurance within 10 calendar days of Notice of Award of the Project, the Owner may award the work to another Bidder or Bidders or, if applicable, may call for new bids.

2.2 The Bidder will be required to (a) submit his bid and Bid Bond, (b) execute Contract and Performance and Payment Bonds, and (c) submit Certification of required insurances.

1.3 Bid Bond is forfeited if bid is withdrawn after the CSP opening, or Contract Documents are not executed in accordance with the above.

10.0 SUBMISSION OF POST COMPETITIVE SEALED COMPETITIVE INFORMATION

The selected Bidder shall within ten (10) days after the Board of Trustees approves the award submit the following:

10.1 A designation of the work to be performed by the Bidder with his own forces.

10.2 An experience profile of the selected Bidder's superintendent scheduled to work on this project. In addition, the apparent selected Bidder shall cooperate with the Owner, supplying requested information to substantiate the qualifications of the superintendent. If, in the opinion of the Owner, the superintendent does not qualify, the Owner may request the submission of another superintendent and more information. The Owner reserves the right to reject the apparent selected Bidder if an acceptable superintendent is not presented.

10.3 A list of names of subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for such portions of the work as may be designated in the bid documents or, if no portions are so designated, the names of the subcontractors proposed for the principal portions of the work.

10.4 The selected Bidder shall within ten (10) days thereafter submit a statement of costs for each major item of work included in the bid. Each section of specifications will be considered a major item of work and shall be shown as a separate cost item.

11.0 NOTICE TO PROCEED

11.1 The Bidder shall not commence work under this Contract until he receives the written Notice to Proceed and the Contract is duly signed by the Owner.

12.0 COMPLETION TIME

12.1 The Owner has a critical need for the work to begin timely and be Substantially Complete by date provided on the Bid Form.

12.2 Having thoroughly familiarized himself with the conditions as they exist at the building sites and acquainted himself with the labor supply and the material market, the Bidder will state in his bid that he agrees to be substantially complete with the work by the date above.

12.3 Under the Base Bid, the successful Bidder will be subject to liquidated damages.

12.4 The definition of Substantial Completion, as defined in Article 9.8.1 of the AIA General Conditions and Supplementary Conditions bound herein, is as follows: "Substantial Completion is the stage in the progress of the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use".

13.0 RETAINAGE

13.1 Contracts will bear a retainage of five (5) percent (%) on each partial disbursement.

14.0 ASBESTOS, LEAD AND PCBs CONTAINING MATERIALS

14.1 The use of any construction process or the installation of any asbestos, lead and PCBs or material containing asbestos, lead and PCBs is strictly prohibited for this Project.

14.2 Prior to submitting a bid, Bidders shall notify the Project Manager, in writing, of any materials in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs.

14.3 Prior to payment of retainage and final payment the Contractor shall furnish a notarized statement certifying that no asbestos, lead and PCBs containing materials have been used in the Project.

14.4 In addition to the Contractor's notarized statement, the Subcontractors will be required to furnish notarized affidavits that no asbestos, lead, and PCBs containing products have been used in this Project.

15.0 AVAILABILITY OF MATERIALS AND SYSTEMS

15.1 A serious effort has been made to select only materials that are asbestos free and systems that are readily available. As far as is known at bid time all items are either available "off the shelf" or within a relatively short period of time. If during the bid period, an Bidder becomes aware of an availability or delivery problem with any of the specified systems or materials or if they contain asbestos, he should notify the Project Manager immediately. The Project Manager will promptly explore possibilities for selecting other systems or materials which would circumvent the problem and notify Bidders of any changes in an addendum, otherwise it will be understood that only specified systems and materials that are asbestos free are included in the bids.

16.0 USE OF ASBESTOS FREE MATERIALS, PRODUCTS AND SYSTEMS

16.1 The Contractor is reminded to refer to the Section above for requirements during the bid period and the following requirements during performance of the Work regarding the use of asbestos free materials, products and systems in the Project.

16.2 Since many materials, products and systems are proprietary, it is not possible to know all of the materials or components which go into producing such material, product or system without the manufacturer divulging trade secrets or patent information. Every effort has been made to specify materials, products or systems, which either as an "off the shelf" material, product or system or as a custom material, product or system do not contain asbestos.

16.3 It is the Contractor's responsibility to submit an affidavit from the manufacturer to ascertain that every material, product or system used in the Project does not contain asbestos. In the event the material, product or system is found to contain asbestos, the Contractor shall offer for the Project Manager's consideration a substitution which he knows does not contain asbestos.

16.4 Even though a material, product or system is specified or a specification is based on a particular material, product or system, the Contractor will not be relieved from the responsibility to ascertain that materials, products and systems used in the Project do not contain asbestos. Under no circumstances shall a material, product or system which is known, suspected or found to contain asbestos be used on the project.

16.5 If a material, product or system containing asbestos is used, the Contractor shall remove and replace the material, product or system with one which is asbestos free at no additional expense to the Owner, including removal and replacement of other materials affected by the removal of the asbestos bearing material, product or system, i.e. gypsum wallboard removed, replaced, and repainted on account of insulation being removed, etc

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FORT BEND INDEPENDENT SCHOOL DISTRICT

GENERAL PROVISIONS

For Purchasing Solicitations and Contracts

July 1, 2023

The following General Provisions are issued in accordance with the laws, rules, and policies set forth through the Texas Education Code, Chapter 44, and Fort Bend Independent School District (FBISD or "District") policy and may be amended as required by FBISD. Prospective Vendors are cautioned to read and understand the General Provisions set forth in this document prior to responding to a FBISD Solicitation. Any exceptions to or failure to follow these General Provisions unless otherwise directed within the Solicitation, may be cause for a Vendor's Solicitation Response to be deemed non-responsive and disqualified by FBISD. These General Provisions will take precedence over the terms and conditions within the Solicitation when they are in conflict unless specific exception is noted within the Solicitation.

INDEX

FORT BEND INDEPENDENT SCHOOL DISTRICT
GENERAL PROVISIONS

Reference Document Version
Effective Date of July 1, 2023

PART I

DEFINITIONS, TERMS AND ACRONYMS

The following terms may be found in this document or may be used in the normal operations of the District's Purchasing Department.

Term	Definition
Addendum	A document that has been issued by the District that has made material changes, modifications, or deletions of information or specifications of a Solicitation.
Agreement/ Contract	A contract that has been agreed upon and signed by both the District and the Vendor.
Bid	Vendor's response to a Request for Bid or RFB. The term may be used to represent all types of solicitations.
Buyer	The Buyer (FBISD Buyer) is the District's approved business representative for all matters of solicitation, evaluation, award, and administration of a Contract Award. There will be only one appointed Buyer at any time for each purchasing action. Vendors shall address all business/contract issues about a Contract Award to the Buyer.
Alternate or Substitute	A good or service substituted for another by a Vendor with approval of the FBISD Buyer.
Conflict of Interest	A Conflict of Interest shall exist when a Vendor or any affiliated person or business entity provides goods or services under a Contract Award whereby one or more personal, business, or financial interests or relationships exist which would cause a reasonable individual with knowledge of the relevant facts to question the integrity or impartiality of those who are or will be acting under a proposed or existing Contract; or any other facts that exist which may cause the District, at its sole discretion, to determine during the Solicitation or the performance of an existing Contract that the Vendor obtained an unfair competitive advantage favoring the interest of the Vendor or any person with whom the Vendor has or is likely to have a personal or business relationship. Conflicts of interest are further defined in FBISD policy and state law.
Contract Award	The acceptance of a Quote, Bid, Proposal or Offer; a Purchase Order, District Contract Agreement, or other formal notification of award issued by an authorized District official.
Contract Documents	A set of documents that create an Agreement that has been agreed upon and signed by both the District and the Vendor. Contract Documents shall include, without limitation, these General Provisions, the Contract, Purchase Orders, and Service Contracts

Contract Term	The length of time a Contract or Agreement will be available for use by the District.
Contractor	The Vendor(s) who receive a Contract Award for a specific Solicitation.
Debarment	Action taken by the District which prevents a Vendor from participating in the solicitation process for a period of time, usually as a result of improper business practices on the part of the Vendor.
Deliverable	Goods or services which are required by a Contract Award to be provided to the District by a Vendor.
Discount Contract	An awarded Contract where pricing is based on a firm-fixed discount from a Vendor's published price list, priced catalog, or other document that is published for the majority of the Vendor's customers.
District	FBISD
District Business Day	Days the District is officially conducting business (excludes weekends, District observed holidays, etc.).
District Web Site	The official District web site, available at http://www.fortbendisd.com
FBISD	Fort Bend Independent School District
Line-Item Contract	An awarded Contract where goods or services are specified and individually priced.
Notice of Award	A formal, written document issued by an authorized official of the District's Purchasing Department informing a Vendor that it has been selected for the Contract Award based on its Solicitation Response.
Offer	Term used in conjunction with or in place of a Vendor's Solicitation Response.
Professional Services Contract	A Contract awarded for performance of technical, professional, and/or unique services by Vendors which are typically licensed such as medical or medical arts professionals, architects, engineers, or lawyers, as described in Texas Education Code 44.031(f).
Proposal	Vendor's response to a Request for Proposal (RFP).
Purchase Order	Formal order for goods, materials and/or services from a Vendor; a binding commitment for the District to remit payment to the Vendor after the specified goods and/or services, and an invoice for the same are received by the District.
Quote	Vendor's response to a Request for Quote.
RFB	Request for Bids. Solicitation method used for acquiring goods or services for one-time purchases or establishing Term Contracts for acquiring goods or services with aggregate values of $50,000 or greater. This solicitation method is formal, and a legal notice is published at time of issuance. This purchasing method is normally used to establish annual contracts for District-wide goods or services, or major one-time purchases. Award is based on Best Value Determination.
CSP	Request for Competitive Sealed Proposal. Solicitation method used primarily for construction projects. Allows for the use of the formal evaluation process and uses the Best Value Determinations for an award. Negotiations are allowed prior to the award.
RFO	Request for Offer. Solely for technology purchases such as those issued through the State of Texas / Department of Information Resources (DIR) procurement processes. May also be used for sale or lease of property belonging to the District.

RFQ	Request for Quote. Used for small dollar purchases valued at less than $50,000. Solicitation method is typically informal (e.g., phone, fax or email) and solicitation requirements are minimal (no advertisement, minimal response time, etc.). May be used for one-time purchases, or to establish low-dollar Term Contracts. May also be used to compare contract pricing from several different contract vehicles such as cooperatives.
RFP	Request for Proposal. Solicitation method used to acquire highly technical, negotiated goods or services. Standard RFPs will allow for evaluations based on specific criteria established within the RFP. Used primarily for higher dollar valued purchases but may be used for smaller purchases where requirements warrant this Solicitation method. Negotiations are allowed prior to the award.
School Business Days	Days the District is officially conducting school (excludes weekends, District observed holidays, etc.)
Service Contract	An awarded Contract for performance of a service by a Vendor for a specified period of time.
Solicitation	General term used to refer to an RFB, CSP, RFO, RFQ or RFP.
Solicitation Response	Vendor's response to an RFB, CSP, RFO, RFQ, RFP or other Solicitation issued by the District
Solicitation Tabulation	Official tabulation of Solicitation Responses, issued by the Purchasing Department after Contract Award.
Subcontractor	Company or business that has contracted with the prime contractor for performing services for the District. The prime contractor is responsible to the District for the work performed by its subcontractor(s). No contract will exist between the subcontractor and the District.
Term Contract	An awarded Contract for delivery of goods or performance of services by a Vendor for a specific period of time.
Vendor	Bidder, Vendor, Offeror, Proposer, or Contractor.
Vendors of Record	The compiled bid list of Vendors for a specific Solicitation, that is to include Vendors that were selected to receive the Solicitation or have notified the District that they have an interest in the Solicitation and are added to the initial list of Vendors.

PART II

SOLICITATION INFORMATION AND INSTRUCTIONS

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1. **DISTRICT OVERVIEW**
   1.1. Fort Bend Independent School District spans over 170 square miles and is located in the northeast part of Fort Bend County, just southwest of Houston and Harris County. FBISD encompasses the incorporated cities of Missouri City, Sugar Land, Arcola, and Meadows Place, a small portion of Houston, and the communities of Clodine, DeWalt, Rosharon, and Fresno.
   1.2. The District currently has eighty two (82) plus campuses and multiple other sites for administration, athletics, agriculture, and support services.
2. **TYPES OF CONTRACTS** Each Solicitation will identify the type of Contract being advertised. One of the following contracting methods will typically be used, but FBISD reserves the right to use any contracting method it deems to be in the best interest of the District:
   2.1. ***Firm-Fixed Price***
      2.1.1. Prices shall be firm fixed for the term specified in the Contract, and all extensions exercised by the District.
      2.1.2. No increases will be allowed during the Contract term.
      2.1.3. Price decreases are acceptable at any time during the term of the Contract.
   2.2. ***Fixed-Price with a Price Adjustment Allowance***
      2.2.1. Prices shall be firm for a term specified in the Contract.
      2.2.2. Prices can be adjusted based on escalation provisions as identified in the Contract.
      2.2.3. The District reserves the sole right to evaluate the applicability of any price adjustment and accept or reject any formula included in any Solicitation Response or accept or reject any Solicitation Response containing a price adjustment proposal.
      2.2.4. FBISD recognizes this product or service has a price component that may have a commodity with changing costs. The Contractor/Supplier may request a Price Adjustment no more frequently than once each quarter (3-month period).
      2.2.5. A Price Adjustment request must be made in writing and include the reason for the request, documentation supporting the request (i.e., commodity increases), the current pricing, and the requested revised pricing. FBISD will review the Price Adjustment request. If the Price Adjustment is deemed reasonable the Price Adjustment request will be accepted by written acknowledgement. If the request is not accepted the FBISD may entirely reject the request or may counter with revised pricing. In either case the FBISD will provide a written explanation in support of the decision. The Director of Procurement Services may use available indexes (e.g., CPI or PPI) to determine if the requested Price Adjustment is reasonable. Typically, a Price Adjustment that exceeds 5% will not be approved unless very unusual and significant changes have occurred in the industry.
      2.2.6. In the event industry costs decline, FBISD shall have the right to request to receive, from the Contractor, a reasonable reduction in prices/pricing that reflect such cost changes in the industry. FBISD will make a written request to the Contractor for a Price Adjustment in writing with supporting documentation.
   2.3. ***Firm-Fixed Discount Percentage, Discount-from-List, or Cost Markup-From-List***
      2.3.1. Discount or cost mark-up shall be firm fixed for the period specified in the Contract, but prices may vary based upon changes in a District approved price list or other pricing document, by the method and frequency as identified in the Contract.
      2.3.2. Used when the pricing is based on a discount or a cost-plus mark-up percentage from an established, publicly recognized price list.
      2.3.3. Prices shall be from a current Vendor’s price list or a cost-plus percentage add-on to a Vendor's distributor/producers price list.
      2.3.4. Vendor's price list shall be the current price list published and available to and recognized by the trade. A price list specially prepared for a given Solicitation will not be accepted. FBISD, in its sole discretion, shall determine the acceptability of such price lists.

2.3.5. Unless otherwise indicated within the Solicitation, the period of acceptance shall be no earlier than one-twenty (120) District Business Days from receipt and approval.

2.3.6. In order for a price list to be changed, if permitted by the Contract terms, a new or amended price list must be submitted to the District's Purchasing Department by the Vendor and approved in writing by the FBISD Buyer within the Contract time specified prior to the requested price change. Otherwise, the last FBISD approved price list remains in effect until such time that FBISD approves the price change. Price changes will not be approved without vendor's documentation supporting cause for increase.

2.3.7. All prices and discount percentages in Vendor's response shall be firm for the term of this Contract. All price changes for products and/or services provided under this Contract must be approved, in writing, by FBISD prior to taking effect and in the same format as was accepted in Vendor's original response.

2.3.8. If the Solicitation includes the option to extend for additional year(s), price increases for each additional year may be negotiated not to exceed the Consumer Price Index (CPI) in the FBISD area at the time of renewal. Prices may be negotiated to prices below the current pricing.

2.3.9. Vendor agrees to promptly lower the proportionate price of any product purchased through this Contract following a reduction in the price the Vendor is paying suppliers.

2.3.10. Prices for this type of Contract cannot be increased during the first year of the contract. For periods beyond year one, prices cannot be increased for 30 days after the Contract renewal commences unless otherwise specified in the Solicitation. Price reductions shall be offered immediately upon becoming available to a Vendor at any time after award.

The following documentation shall be provided to support a request for a price change:

- justification for change/increase
- terms and conditions
- market conditions
- manufacturers'/distributors' impact if any

All price decreases shall be allowed for all products and/or services.

2.3.11. ***Pricing, Purchase Orders, Invoices, and Payments***

If pricing for products or services available under this Contract are provided at a lower price to an eligible Customer who is not purchasing those products or services under this Contract or any other entity or consortia authorized by Texas law to sell said products and services to eligible Customers, then the available Customer Price in this Contract shall be adjusted to that lower price. This requirement applies to products or services quoted by Vendor or its resellers under this contract for a quantity of one (1) under like terms and conditions and does not apply to volume or special pricing purchases. This Contract shall be amended within ten (10) business days to reflect the lower price.

3. **CONFLICT OF INTEREST**

3.1. ***Disclosure of Certain Relationships with Local Government Officials***

3.1.1. Any individual or business entity that contracts or seeks to contract for the sale or purchase of property, goods, or services with FBISD must file a Vendor Conflict of Interest Questionnaire with the FBISD Purchasing Office in accordance with Texas Local Government Code Chapter 176, and in the event that a conflict arises, no later than the 7th business day after the recipient becomes aware of facts that require filing.

3.1.2. This requirement applies to a person who is an agent of a vendor in the Vendor's business with the District. The Texas Ethics Commission's website at: www.ethics.state.tx.us/data/forms/conflict/CIS.pdf

3.2. ***Employee***

3.2.1. Pursuant to FBISD Policy CH (Local) Purchasing and Acquisition, and DBD (Local) Employment Requirements and Restrictions, all Vendors must disclose the name of any FBISD employee who owns, directly or indirectly, an interest in the Vendor's firm or any of its branches.

3.2.2. Failure to provide such conflict-of-interest information may be grounds for disqualification of the Solicitation Response or cancellation of a contract resulting from this Solicitation.

3.2.3. Purchase of services or equipment from a business owned in whole or in part by a District employee shall be permitted only when approved by the Superintendent and executed through a documented competitive process.

4. **SOLICITATION PRICING** Solicitation prices must be firm for one hundred twenty (120) days from Solicitation

opening/bid closing date until award unless otherwise specified in the Solicitation.

5. **QUANTITIES** Any quantities listed within the Solicitation are a close approximation based on requirements and available funds, but FBISD reserves the right to purchase more or less than the estimated quantities, at the current Contract price, for the term of the agreement unless otherwise specified in the Solicitation. Unless otherwise agreed in writing, FBISD will engage Contractor on an "as needed if needed" basis and does not guarantee the purchase of any quantity or dollar amount of Services.
6. **REQUEST FOR EXPLANATION / INTERPRETATION**
   - 6.1. Any explanation desired by a Vendor regarding the meaning or interpretation of this Solicitation must be submitted in writing to the Buyer identified in the Solicitation in accordance to the Solicitation instructions , in order to allow a response to all interested Proposers before the submission of a bid.
   - 6.2. The District has provided an email address or method of communication intended for interested Proposers to direct requests for clarification, interpretations, and/or questions of current Solicitations in each respective solicitation.
   - 6.3. All requests must include all contact and Solicitation information to be considered. Failure to provide this information may delay a response from the District. Any interpretations, corrections, additions, or changes to the Solicitation will be communicated to all interested Vendors though the issuance of an Addendum. It is the responsibility of the Vendors, prior to submitting their Solicitation Response, to determine whether an Addendum has been issued. All Vendors shall comply with the requirements specified in any Addendum(a) issued by the District.
   - 6.4. Once a request is received, a notification of receipt by the District will be forwarded to the Vendor's contact email address.
7. **DELIVERY TERMS**
   - 7.1. All goods or products included in the Solicitation shall be F.O.B. ("Free on Board") destination full freight allowed, unless otherwise indicated within the Solicitation.
   - 7.2. All goods or products will be considered full freight prepaid and allowed and included in the unit price.
8. **SUPPLIER DIVERSITY INITIATIVE** The FBISD Supplier Diversity Initiative (SDI) ensures that the District will use its best efforts to encourage small businesses to participate in current and future purchasing of all goods and services.
   - 8.1. ***Program Definitions***
     - 8.1.1. *"Small Business"* is defined as a business entity which is independently owned and operated, and which is not dominant in its field of operation. The business employs less than 50 employees and/or has less than $3 million in annual business volume from this local operation.
   - 8.2. ***Certification***
     - 8.2.1. Any business wishing to be identified by FBISD as a small business shall be certified as such by the:
       - 8.2.1.1. Port of Houston Authority SBE Certification.
       - 8.2.1.2. Metropolitan Transit Authority of Harris County (METRO) SBE Certification.
       - 8.2.1.3. City of Houston SBE Certification; or
       - 8.2.1.4. Small Business Administration - SBA 8A (if authorized by the District for a particular procurement).

9. **SAMPLE REQUIREMENTS**
   - 9.1. The District may require a sample of a product at any time for evaluation and testing, from a Vendor participating in a Solicitation process or a Vendor supplying items to the District under contract.
   - 9.2. The Vendor should not submit a sample with the Solicitation Response unless directed to do so.
   - 9.3. ***Request of Sample***
     - 9.3.1. If it is determined that a sample is required as part of the Evaluation Process, the requirement will be issued in writing to the Vendor by the Buyer.
     - 9.3.2. Samples must be received by the District's Purchasing Office by the deadline established in the Buyer's written notification.
     - 9.3.3. A representative sample of the item(s) offered must be provided. Award recommendations will be based on samples and any future items ordered will be of the same quality and grade of the sample submitted.
     - 9.3.4. The Vendor will cover all costs in shipping and providing the sample product to the District.
     - 9.3.5. Failure to provide a requested sample may disqualify the Vendor from further consideration in

award of the associated Solicitation item.

9.3.6. If a sample is found to not meet the Solicitation specifications or the intended purpose of the product, the associated Solicitation item will be disqualified.

9.4. ***Sending of Samples***

9.4.1. If a sample is required by the District, samples must be clearly marked with the following information:

9.4.1.1. The word "Sample" in large print;

9.4.1.2. The name of the company submitting the sample; and

9.4.1.3. The number and title of the Solicitation or Contract.

9.5. ***Return of Samples***

9.5.1. Unless specifically requested, all samples provided shall become the property of FBISD.

9.5.2. If the sample is required by the Vendor to be returned, any and all costs associated with the return of the sample will be the responsibility of the Vendor. FBISD shall not be liable for any damage to the sample.

PART III
SOLICITATION RESPONSE

1. **PREPARATION OF A SOLICITATION RESPONSE** In preparation of a Solicitation Response, each Vendor shall:
   - 1.1. Furnish all information required by the Solicitation by the due date and time.
   - 1.2. Authorized Signature
     - 1.2.1. Solicitation Responses must be signed and/or submitted only by individuals who have been given authority to bind the Vendor under contract.
   - 1.3. Have all erasures or other changes initialed by the signer of the Solicitation Response.
   - 1.4. Solicitation Responses submitted on other forms or with different terms or provisions may be deemed non-responsive by FBISD and disqualified.
   - 1.5. Unless otherwise instructed by the Solicitation, Vendors shall submit the lowest and best price, F.O.B. destination, freight prepaid and allowed, on each item, including packaging and transportation.
   - 1.6. An unsigned Solicitation Response will be deemed non-responsive by FBISD and disqualified. Solicitation Responses cannot be signed after the Solicitation opening time even though the Vendor or a representative is present at the Solicitation opening.
   - 1.7. By submitting a proposal vendor you are acknowledging that you agree to the terms and conditions of the proposal and incorporated here by reference. An unsigned Solicitation Response will be deemed non-responsive by FBISD and disqualified. Solicitation Responses cannot be signed after the Solicitation opening time even though the Vendor or a representative is present at the Solicitation opening.
   - 1.8. By submitting a proposal vendor agrees to any Terms & Conditions of this solicitation and in case of
   - 1.9. conflict with other documents provided by the vendor, these Terms and Conditions take precedence and prevail unless specifically identified and changes are signed by both parties.
   - 1.10. All Solicitation Responses and accompanying samples or documents of any kind become the property of FBISD and are subject to the Texas Public Information Act The District will be under no obligation to return any part of a Solicitation Response to a Vendor.
2. **ADDENDA**
   - 2.1. Should an addition or correction become necessary after a Solicitation is issued, an Addendum or notice of the availability of such an Addendum will be posted on the District e-bidding Web Site https://fortbendisd.bonfirehub.com/portal/openOpportunities. Vendors of Record with FBISD are those Vendors having received a copy of the initial Solicitation or notice of the availability of a copy on-line.
   - 2.2. Vendors who do not submit a Solicitation response without receipt of all Addenda issued, may be deemed non-responsive by FBISD, and disqualified.
   - 2.3. Vendors shall acknowledge an Addendum by returning the Addendum in a separate response, or with the Solicitation, or by physically noting the change or addition on the Solicitation Response with a notation acknowledging the Addendum.
   - 2.4. Failure to return or acknowledge an Addendum may be deemed non-responsive by FBISD and result in disqualification.
3. **BRAND NAME AND PRODUCT NUMBER REFERENCE**
   - 3.1. If applicable to the Solicitation, the use of referenced brand/stock numbers in a Solicitation are for brevity in establishing minimum specifications and are not intended to be restrictive.
   - 3.2. “Buyers approved equal” indicates that the District will consider other manufacturer’s product that meets or exceeds the published specifications. The District shall make the final determination of acceptable substitutions.
   - 3.3. Unless no exception is made to the reference manufacturer’s product, the alternate manufacturer, trade and/or brand name and number must be indicated for each item bid. The Bidder will be required to forward any illustrations that render its equivalency. Any additional specifications must reference the line-item number that it corresponds to.
   - 3.4. Products of inferior quality will be rejected.
   - 3.5. If the bid space is left blank, the District will consider it a ‘no bid’.
4. **ATTACHMENTS**
   - 4.1. Vendors may include attachments to describe goods or services being offered and/or to exhibit that products offered meet all written specifications; however, Vendors shall not submit samples unless requested to do so.
   - 4.2. Page and paragraph numbers shall properly reference each page of an attachment in the Solicitation

Response.

4.3. The name of the Vendor submitting the attachment shall also be prominently displayed on each page of the attachment.

4.4. No terms or conditions recorded on any attachment will be considered binding unless specifically made a part of the Solicitation Response in writing and specifically incorporated into the resulting contract.

4.5. **WARNING:** ***Any added terms or conditions may result in disqualification of a Solicitation Response, e.g., Solicitation Reponses subject to laws of a state other than Texas, requirements for prepayment, limitations on remedies, waiver of immunities, change in venue, etc.***

5. **SITE VISITATION**

5.1. The Vendor shall be responsible for fully understanding the scope of the Solicitation, and if considered applicable to the goods or services being solicited, the District recommends that Vendors visit the FBISD site and examine the space and/or equipment to be serviced. Vendors shall obtain prior FBISD Buyer approval for any site visit.

5.2. Pre-submittal conferences may be established by the District to allow Vendors access to the associated facility.

5.3. The prospective Vendor shall carefully examine the venue(s), specifications, and requirements.

5.4. If necessary, Vendors shall secure additional information from the FBISD Buyer that may be requisite to a clear and full understanding of the work.

6. **REFERENCES**

6.1. If required in the Solicitation, the Vendor is to submit references that have contracted with their company to provide like products or services. It is recommended that the Vendor include school districts or other local government organizations similar to FBISD in size and structure as references, if possible. References should include the company name, address, contact name, phone number and email address.

6.2. The District reserves the right to use the results of the reference check in the evaluation process, including information obtained from references other than those identified by the Vendor. A negative reference or references may cause a Solicitation Response to be rejected.

7. **CERTIFICATIONS AND REPRESENTATIONS**

7.1. The Vendor shall complete, sign and provide all documents as required by the Solicitation. Document must be signed by an authorized representative who may legally bind the company and is to be included with the Solicitation Response for the response to be considered. Failure to sign and submit required documents may disqualify the Solicitation Response

7.2. Based on the type of Solicitation, the forms that may be required are:

7.2.1. Felony Conviction Notice. State of Texas Education Code, Section 44.034 requires that a person or business entity (excluding publicly held corporations) that enters into a Contract with the District give advance notice to the District if the person or an owner or operator of the business entity has been convicted of a felony.

7.2.2. Proposal Submission Form (Proposals only).

7.2.3. Conflict of Interest Disclosure. Prior to and as a condition of doing business with FBISD, Vendor shall complete a Conflict-of-Interest Disclosure Form, and shall disclose any business relationship, past or present, with a sitting Board member or FBISD employee. Failure to disclose the existence of any such relationship may disqualify the Solicitation Response or be grounds for termination of an award or agreement.

7.2.4. Relationships with Foreign Entities.

7.2.4.1. In accordance with Texas Government Code Chapter 2252, Subchapter F, Vendor shall certify that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, the Government of Iran, the Government of Sudan, or a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State.

7.2.4.2. Vendor shall certify, pursuant to Texas Government Code Chapter 2270, neither Vendor, nor any affiliate, subsidiary, or parent company of Vendor, if any (the "Vendor Companies"), boycotts Israel, and Vendor agrees that Vendor and Vendor Companies will not boycott Israel during the term of any award or agreement.

7.2.5. W-9 Certificate. The Vendor is required to register in Bonfire and upload a copy of a W-9 Vendor Identification Number Certificate to expedite the payment process if awarded a Contract. A copy of the form can be found at https://www.irs.gov/forms-pubs/about-form-w-9.

7.2.6. If you have previously submitted your W9, you are required to submit an updated version if there are

any changes.

7.2.7. Suspension and Debarment Certification
7.2.8. EDGAR Certifications
7.2.9. Data Protection Addendum This document is required for Solicitations that involve the District's data
7.2.10. Vendor ACH/Direct Deposit Authorization Form will be requested if awarded a Contract.
7.2.11. Certification Regarding Lobbying
This certification is a prerequisite for making or entering into a transaction imposed by Section 1352, Title 31, US Code.
7.2.12. Certificate of Residency
Texas Education Code Chapter 2252, Subchapter A addresses non-resident contractors. As a result, Fort Bend ISD obtains this form as part of the Solicitation Response to determine the residency of its proposers.

8. **SUBMISSION OF SOLICITATION RESPONSES**
8.1. A Solicitation Response shall represent a true and correct statement and shall contain no cause for claim of omission or error.
8.2. If directed by the Solicitation, the Vendor shall provide any and all certifications, forms, and documents as stated within the Solicitation.
8.3. Responses
8.3.1. Solicitation Response must contain:
8.3.1.1. The signed proposal document page of the Solicitation;
8.3.1.2. Specification documents, if applicable;
8.3.1.3. The certifications and representations as applicable;
8.3.1.4. Any additional documents required by the Solicitation.
9. **WITHDRAWAL OF A SOLICITATION** Any Vendor who, in FBISD's sole discretion, is extended the privilege of withdrawing a Bid because of having proven mechanical error in the Solicitation Response may not be considered for an Award on similar items for a length of time deemed appropriate by the District, usually considered to be one (1) year or longer.
10. **SOLICITATION RESPONSE CERTIFICATION** By signing and submitting a Solicitation Response, the Vendor certifies and represents to FBISD that:
10.1. The Solicitation Response has been reviewed by an authorized representative of the company or firm submitting the bid, proposal, offer or other Solicitation Response document.
10.2. The Vendor's firm or any of its individuals have not colluded, conspired, connived or agreed, directly or indirectly, with an entity or person, to put in a sham Solicitation Response or bid or to refrain from responding to the Solicitation, and have not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix its Solicitation Response price, or that of any other vendor, or to fix any overhead, profit or cost element of said Solicitation Response price, or of that of any other Vendor, or to secure any advantage against FBISD or any person interested in the Solicitation, and that all statements in its Solicitation Response are true;
10.3. The contents of the Solicitation Response as to price, terms and conditions or other details of the Solicitation Response have not been communicated by the Vendor or by any employee or agent to any other person engaged in this type of business prior to the official opening of the Solicitation; and
10.4. Vendor has read and understands the Solicitation and these General Conditions (including without limitation, the Contract Terms, Conditions, and Requirements set forth in Part V, below).
11. **LATE SOLICITATION RESPONSES**
11.1. Late Solicitation Responses, or components of a solicitation response, will **NOT** be considered under any circumstances.
11.2. A Solicitation Response will be considered late if the Solicitation Response is not received at the Purchasing Department Solicitation Response Desk by the deadline provided in the Solicitation.
11.3. The Purchasing Department will not be responsible for, and no allowances will be made for, misrouting of a Solicitation Response within the District, delays caused by the Post Office, technical delays or problems, courier services, or any other delays.
11.4. The official deadline date and time is determined by the Purchasing Department.
12. **THE DISTRICT IS TAX-EXEMPT**

12.1. FBISD is tax-exempt. Proposal prices should not include taxes.

13. **OPEN RECORDS POLICY**

13.1. FBISD is a governmental body subject to the Texas Public Information Act. Solicitation Responses submitted to FBISD as a result of this Solicitation may be subject to release as public information after contracts are executed or the procurement is terminated. If a Vendor believes that its Solicitation Response, or parts of its Solicitation Response, may be exempted from disclosure under Texas law, the Vendor must specify page-by-page and line-by-line the parts of the Solicitation Response which it believes are exempt. In addition, the Vendor must specify which exception(s) to the Texas Public Information Act are applicable and provide detailed reasons to substantiate the exception(s). Vague or general claims to confidentiality will not be accepted. FBISD assumes no obligation or responsibility relating to the disclosure or nondisclosure of information submitted by Vendor.

14. **INTERPRETATION**

14.1. A Solicitation represents the basis for any Award and supersedes all prior offers, negotiations, exceptions and understandings (whether orally or in writing). Submitted Solicitation Responses should be self-explanatory and should not require any clarification or additional information.

15. **SOLE SOURCE**

15.1. In order to become a Sole Source Vendor, a Vendor must meet the requirements of Texas Education Code § 44.031(j) Sole Source, as described below.

15.1.1. Selected purchases may be exempt from competitive procurement if they meet the established criteria for a sole source purchase:

15.1.1.1. Identification and confirmation that competition in providing the item or product to be purchased is precluded by the existence of a patent, copyright, secret process or monopoly

15.1.1.2. Identification and confirmation that the product is a film, manuscript, book, utility service (including electricity, gas, or water), or a captive replacement part or component for equipment.

15.1.1.3. Sole source does not apply to mainframe data-processing equipment and peripheral attachments with a single item purchase price in excess of $15,000.

15.2. It is incumbent upon the District to obtain and retain documents from the Vendor which clearly delineate the reasons that qualify the purchase to be made on a sole source basis. In order to do business with FBISD as a Sole Source Vendor, FBISD must receive a notarized Sole Source Affidavit along with proof of Vendor's company qualifying as a sole source.

16. **GENERAL CORPORATE AND CONTACT INFORMATION**

Vendors are required to attach all the following in the Solicitation Response:

- Describe the company's official registered name and its principals.
- Provide a brief history of the company, including the year it was established.
- Provide the company's organizational chart.
- Provide the company's Dun & Bradstreet (D&B) number.
- Provide a description of the company's relevant market and the company's position within it.
- State whether the Vendor or the Vendor's ultimate parent company or majority owner: (A) has its principal place of business in this state; or (B) employs at least 500 persons in this state.
- Vendor agrees to provide the District with the following financial information if requested by FBISD at any point during the procurement process, including before or after contract award: If public, the Vendor's income statement, balance sheet, and cash flow for the past three (3) years; if private, the Vendor's audited financial statements for the past two years (if available). A Vendor's failure to provide this financial information may impact the FBISD administration's recommendation to the FBISD's Board of Trustees for the award of the contract.

PART IV

SOLICITATION EVALUATION AND AWARD

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1. **RESERVATIONS** The District expressly reserves the right to:
   - 1.1. Waive minor deviations from specifications, if the District determines that overall cost of the goods or service will be lower and the overall function is improved or not impaired;
   - 1.2. Waive any minor informality or deficiency in any Solicitation procedure;
   - 1.3. Accept, reject, or negotiate modifications in any terms of a proposed Vendor's Solicitation Response, or any parts thereof;
   - 1.4. Waive any formalities or technicalities if deemed in the best interest of the District;
   - 1.5. Reject any or all Solicitation Reponses;
   - 1.6. Cancel the Solicitation;
   - 1.7. Reissue a Solicitation;
   - 1.8. Extend the Solicitation opening time and date, the Contract Award date, or both;
   - 1.9. Specify approximate quantities;
   - 1.10. Increase or decrease the quantity specified in the Solicitation;
   - 1.11. Consider and accept alternate Solicitations, if specified in the Solicitation, when it is considered in the best interest of the District;
   - 1.12. Procure any goods or services by other means;
   - 1.13. Purchase no goods or services;
   - 1.14. Award one or more contracts, in part or in whole, to a single or to multiple prospective Vendors. The decision to award multiple contracts, award only one contract, or to make no awards rests solely with FBISD. FBISD may make multiple awards, and this fact should be taken into consideration by each Vendor;
   - 1.15. Award contracts for individual products or services as may appear advantageous;
   - 1.16. Negotiate separately in any manner necessary to serve the best interests of the District; and
   - 1.17. Be sole judge of quality and equality.
   - 1.18. FBISD assumes no financial responsibility for any costs incurred by prospective Vendors in developing and submitting a Solicitation Response, participating in bid conferences (if any), participating in any negotiation sessions or discussions, or any other costs incurred by Vendors prior to award of a contract pursuant to any Solicitation.
2. **COMPETITIVE SELECTION USING BEST VALUE**
   - 2.1. ***Solicitation***
     - 2.1.1. All formal Solicitations will be evaluated using the Best Value method as defined in Texas Education Code 44.031(b).
     - 2.1.2. The Solicitation will usually indicate the criteria and ranking to be used to determine Best Value. In the absence of criteria in the Solicitation, the criteria in 2.1.3 will be used.
     - 2.1.3. In determining Best Value the District will consider any or all of the following:
       - 2.1.3.1. Purchase price;
       - 2.1.3.2. Reputation of the Vendor and of the Vendor's goods or services;
       - 2.1.3.3. Quality of the vendor's goods or services;
       - 2.1.3.4. Extent to which the goods or services meet the District's needs;
       - 2.1.3.5. Vendor's past relationship with the District;
       - 2.1.3.6. Total long-term cost to the District to acquire the Vendor's goods or services;
       - 2.1.3.7. Any other relevant evaluation criteria specifically listed in the Solicitation;
   - 2.2. ***Award***
     - 2.2.1. Award will not necessarily be made to the Vendor submitting the lowest priced offer.
     - 2.2.2. After Solicitation Responses are received, FBISD may make an Award or Awards without discussion with any Vendor. FBISD reserves the right to conduct interviews, oral presentation, negotiations if applicable, or any other requirements deemed appropriate with only one, with some, or with all Vendors, in compliance with applicable procurement laws. Solicitation Responses should, therefore, be submitted on the most favorable terms.
3. **EVALUATION** The District will evaluate all Solicitations based on the following procedures:
   - 3.1. ***Objective*** Objective evaluation is:

3.1.1. Based on a set of pre-determined criteria using formulas and/or sets of ranges; and
3.1.2. By normal District processes, does not include an evaluation team.

3.2. ***Subjective*** Subjective evaluation is:
3.2.1. Based on a set of pre-determined criteria; and
3.2.2. By normal District processes, includes the use of an evaluation team to determine the scoring.

4. **AWARD OF CONTRACT**

4.1. FBISD will indicate acceptance of a Vendor's Solicitation Response by issuance of a Purchase Order, Contract, or other form of Notice of Award to awarded Vendor(s) at completion of the evaluation of Solicitation Responses and upon approval by the Board of Trustees.

4.2. If the Contract is issued in the form of a Purchase Order, the Purchase Order together with any other documents which the FBISD Buyer has attached and/or referenced as part of the Purchase Order, constitutes an offer by the FBISD Buyer to purchase from the Vendor the goods and/or services indicated, subject to these General Provisions. The Purchase Order, together with these General Provisions, and their attachments and/or referenced documents, is the sole and complete Contract between the District and Vendor with respect to the goods and services ordered and supersedes all prior oral and written understandings. No additional terms or modifications to the Purchase Order proposed by the Vendor in any acknowledgement, sales order, or other form of communication shall be binding on the District. The FBISD Buyer's failure to object to provisions contained in any communication from the Vendor shall not be deemed a waiver of the provisions or an approval of the terms.

4.3. Acceptance of the Purchase Order is conditional on Vendor's consent to the terms and conditions in these General Provisions. FBISD expressly objects to and rejects any terms or conditions in addition to or different from those contained in these General Provisions, whether previously or hereafter proposed in any form from Vendor unless the FBISD Buyer has expressly agreed to them in writing. By submitting a Solicitation Response to the District to provide goods or services, Vendor acknowledges receipt and willingness to accept all terms and conditions contained in these General Provisions.

4.4. ***Order of Precedence***

4.4.1. If a formal Contract, Agreement or Purchase Order is issued, the terms and conditions of the Contract shall be governed in the following order of importance/precedence:

4.4.1.1. The formal Contract, Agreement, or purchase order;
4.4.1.2. These General Provisions;
4.4.1.3. Any Addenda to the Solicitation submitted prior to the opening of the Solicitation;
4.4.1.4. The original Solicitation;
4.4.1.5. The accepted portions of the Vendor's Solicitation Response; and
4.4.1.6. Any subsequent contractual documents agreed upon by both parties.

4.4.2. Failure to accept this obligation may result in the cancellation of any award;

4.4.3. Any damages suffered by the District as a result of the Vendor's failure to Contract shall be recovered from the Vendor.

4.5. ***Partnership and/or Subcontracting*** If the Vendor has joined with one or more business partners or is Subcontracting any work to respond to the Solicitation, FBISD reserves the right to:

4.5.1. Reject the Vendor's offer based on that/those partnerships(s) and/or Subcontractors.

4.5.2. Accept, at its option, subsequent offers with new partnership(s) and or Subcontractors, should the Subcontracting Vendors in the initial offer be unacceptable for any reason.

4.6. ***Multiple Vendors*** FBISD reserves the right to award Contracts to multiple Vendors if such Vendors offer items that are unique and have value to FBISD.

4.7. ***Formation of Contract*** A response to a Solicitation is an offer to contract with FBISD based upon the terms, conditions, scope of work, and specifications contained in the Solicitation and in these General Provisions. A Solicitation Response does not become a contract unless and until it is accepted and executed by FBISD.

PART V

CONTRACT TERMS, CONDITIONS, AND REQUIREMENTS

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1. **GENERAL TERMS**

1.1. ***Titles***. The awarded Vendor shall be hereby known in the section as “Contractor”.

1.2. ***Term of Contract, Renewals and Extensions***

1.2.1. The Contract established by the Contract Award shall be in effect from date of award or the commencement date, whichever is later, and shall continue for the term stated in the Contract. Typically, the base term is one year.

1.2.2. Any Purchase Orders dated during the term of the Contract must be honored even if received after the Contract expiration date. Contractors may not specify a "final order" receipt date.

1.2.3. Pricing is established by the date the order is placed unless otherwise stated in the Contract.

1.2.4. Renewal Contracts. In addition to the initial base contract term, the District shall have the right to renew the contract for a period described in the official solicitation. Renewals may be offered for additional terms (for example, one-year base term + 4 one-year renewals = 5/years total) provided both FBISD and Vendor are in mutual agreement.

1.2.5. Short Term Contract Extension.

1.2.5.1. If the District determines that additional time is required to avoid a Contract lapse, it may, at its sole option, extend the Contract in 30-day increments, up to 180 days, under the current Contract pricing, terms and conditions.

1.2.5.2. Such extension will be done in writing prior to the end of the current Contract term.

1.3. ***Price Escalations*** The prices in Contractor’s Solicitation Response shall be firm for the term of the Contract. The District shall only allow price escalations within a Contract if such provisions were identified within the original Solicitation. Contract renewals will allow for escalation only at the time of renewal and Contractor must submit price escalation, along with a justification for such increase, on manufacturer’s letterhead, using the same format used in Contractor’s Solicitation Response. District shall review escalation amount and determine if escalation is acceptable or not. All price changes shall be subject to the District’s prior written approval.

1.4. ***Availability of Funds***

1.4.1. Any Agreement or Purchase Order resulting from a Solicitation is contingent upon the continued availability of appropriations and is subject to cancellation by the District, without penalty, either in whole or in part, if funds are not appropriated by Fort Bend ISD’s Board of Trustees or otherwise not made available to the District.

1.4.2. The District's payment obligations are payable only and solely from funds appropriated and available for the purpose of the purchase.

1.4.3. The absence of appropriated or other lawfully available funds may render the Contract Award null and void to the extent funds are not appropriated or available and any Deliverables delivered but unpaid shall be returned to the Contractor.

1.4.4. The District shall provide the Contractor written notice of the failure of the District to make an adequate appropriation for any fiscal year to pay the amounts due under the Contract Award, or the reduction of any appropriation to an amount insufficient to permit the District to pay its obligations.

1.4.5. No penalty shall accrue to FBISD in the event this provision is exercised, and FBISD shall not be obligated or liable for any future payments due or for any damages as a result of termination under this section.

1.5. ***Confidentiality*** Subject to the Texas Public Information Act and any legal requirements, neither FBISD nor the Contractor shall disclose any confidential information without prior written approval. As applicable, Contractor shall maintain and process all information it receives from the District in compliance with all applicable data protection/privacy laws and regulations and FBISD policies. Contractor and FBISD understand that the Family Educational Rights and Privacy Act (FERPA), 20 U.S.C. § 1232g, governs the privacy and security of educational records and information and agree to abide by FERPA rules and regulations, as applicable. Contractor also acknowledges that FBISD is subject to the Texas Public

Information Act, and Contractor waives any claim against and releases from liability FBISD, its officers, employees, agents, and attorneys with respect to disclosure of information provided under or in this Contract or otherwise created, assembled, maintained, or held by Contractor and determined by FBISD, the Attorney General of Texas, or a court of law to be subject to disclosure under the Texas Public Information Act.

1.6. ***Federal Funding*** The following shall be applicable to Solicitations that are funded by federal funds:

1.6.1. This section is applicable only for products or services to be paid with federal funds.

1.6.2. If federal funds will be used to pay for products of services, the Parties understand and agree the Agreement is subject to appropriation, approval, and disbursement of such funding by the United States federal government and its funding administrators, including, but not limited to, the Texas Education Agency. As applicable, the Parties agree to comply with any terms, conditions, and policies related to the use of federal funds, including, but not limited to, the Education Department General Administrative Regulations ("EDGAR") and any other requirements related to applying for, receiving, managing, and reporting federal funds. Contractor shall complete the required "EDGAR Certifications." Noncompliance or misrepresentation regarding this certification may be grounds for termination of an Agreement.

1.6.3. If FBISD does not receive sufficient funding, upon written notice to Contractor, FBISD may terminate an Agreement without penalty or further obligation to Contractor at the end of the period for which funding is available.

1.6.4. All contracts paid with federal grants shall be effective only during the period of availability of the funds identified in the Notice of Grant Award ("NOGA"). An Agreement is effective only after the NOGA is issued.

1.6.5. Federal Law (A-102) Common Rule and (A-110) OMB Circular prohibits non-federal entities, including school districts, from contracting with or making sub-awards under covered transactions to parties that are suspended or debarred or whose principals are suspended or debarred. Covered transactions include procurement Contracts for goods or services equal to or in excess of $100,000 and all non-procurement transactions (e.g., sub-awards to sub-recipients). Contractors receiving individual awards for $100,000 or more and all sub-recipients must certify that the organization and its principals are not suspended or debarred. By signature of the Solicitation, the Contractor affirms that neither it nor its principals are suspended or debarred by a federal agency.

1.7. ***Contract Kick-off Meeting***

1.7.1. The District reserves the right to require the Contractor(s) to meet with District representatives prior to the start of the Contract.

1.7.2. The meeting, if any, shall include, at a minimum, discussion of the performance requirements, service specifications, expectations of professionalism, and access issues, if necessary.

1.8. ***Periodic Performance Reviews***

1.8.1. The District reserves the right to require periodic performance reviews with the Contractor(s).

1.8.2. These reviews shall evaluate at a minimum, the Contractor's ability to:

1.8.2.1. Provide goods or perform services within the required specifications and/or performance requirements;

1.8.2.2. Meet the District's schedule; and

1.8.2.3. Perform in a professional manner.

1.9. ***Usage Reports***

1.9.1. The District will have the right to require the Contractor to provide usage reports of the goods or services purchased from the Contractor during the Contract Period. Usage reports will be computer generated format and made available in 5-7 business days after request.

1.9.2. This right may, at the District's option, be extended beyond the end of the Contract term for a maximum of two (2) years.

1.9.3. The reports shall be in a mutually agreed upon format that is useful by the District and made available by the Contractor.

1.10. ***Rights to Work(s) Made for Hire***

1.10.1. All Work(s) Made for Hire, as that term is defined by the U.S. Copyright Law, shall be the sole property of the District. If commissioned by the District, paid or unpaid, to create a design, artwork, or custom-made product or service, the District shall be sole owner of any copyrights available for the end product.

1.10.2. Contractor hereby assigns all its rights, title and interest in any and all Work(s) Made for Hire and all drafts thereof, including all worldwide copyright ownership rights in the Work(s) Made for Hire, to the District.

1.10.3. The Contractor shall turn over all relevant items relating to the Work Made for Hire, physical or electronic, to the District upon request. The District has the right to legible and complete copies of any and all such work papers upon the District's request.

1.11. ***Disclosure of Intellectual Property Produced***

1.11.1. Contractor shall promptly disclose to the District all copyrights, trademarks, service marks, and/or patents ("Intellectual Property") which Contractor or Contractor's employees, Subcontractors, or Subcontractor's employees may produce, either solely or jointly with others, during the course of the services performed under the Contract.

1.11.2. All such Intellectual Property shall automatically become the property of the District.

1.11.3. In addition, Contractor shall promptly disclose to the District all Intellectual Property to which Contractor may acquire rights in connection with the performance of the services hereunder.

1.11.4. Any disclosure under this paragraph shall contain sufficient technical detail to convey a clear understanding of the Intellectual Property, and shall identify any publication, sale, public use, or impending publication thereof.

1.11.5. Promptly upon request, Contractor shall supply such additional information related to the Intellectual Property as the District may require.

1.11.6. Modification and Derivative Works.

1.11.6.1. The District shall have the right, in its sole discretion, to independently modify and/or create derivative works of any Intellectual Property incorporated in the services for the District's own purposes and use, through the services of its own employees or independent contractors.

1.11.6.2. The District shall own all Intellectual Property Rights to such modifications and/or derivative works.

1.11.6.3. Contractor shall comply with all laws and regulations relating to Intellectual Property. Contractor represents and warrants to the District that Contractor shall not infringe upon any Intellectual Property Rights of any third party. **CONTRACTOR SHALL INDEMNIFY AND HOLD FBISD HARMLESS FROM ALL CLAIMS, LIABILITIES, COSTS, SUITS OF LAW OR IN EQUITY, EXPENSES, ATTORNEYS' FEES, FINES, PENALTIES OR DAMAGES ARISING FROM CLAIMED INFRINGEMENT OF ANY INTELELCTUAL PROPERTY IN CONNECTION WITH THE CONTRACT.** Contractor's obligations under this clause shall survive acceptance and payment by FBISD.

1.11.6.4. Contractor shall require its employees to execute any agreements, assignments, licenses or other instruments, and to provide information related to Intellectual Property, as may be necessary to effectuate the provisions of this Contract.

1.11.6.5. Contractor shall require its Subcontractors and Suppliers to execute any agreements, assignments, licenses or other instruments, and to provide information related to Intellectual Property, as may be necessary to effectuate the provisions of this Contract.

1.12. ***Gratuities and Bribes***

1.12.1. The District may, by written notice to the Contractor, cancel a Contract without liability to the District if it is determined by the District that gratuities or bribes were offered or given by the Contractor or any principle, agent or representative of the Contractor to any officer or employee of the District with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such Contract.

1.12.2. In the event the Contract is canceled by the District pursuant to this provision, the District shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by the Contractor in providing such gratuities.

1.13. ***Delays by the District*** The District will have the right to delay a scheduled delivery or other service performance dates by written notice to the Contractor if the District deems such is in FBISD's best interest.

1.15. ***Delays by the Contractor***

1.15.1. If a Contractor foresees the delay of a scheduled delivery of a product or other service performance date, Contractor shall give timely written notice to the District.

1.15.2. The District may, at its sole discretion, extend the delivery or service date for valid reasons.

1.15.3. The Contractor must keep the District advised at all times of the status of the goods or services.

1.15.4. If the delay will create a burden on the District, the District reserves the right, without liability, in addition to its other rights and remedies, to terminate the Contract by notice effective when received, and to use any other means available to secure the goods or services outside the Contract, and receive reimbursement from Contractor for any loss incurred by the District as a result.

1.16. ***Warranties and Remedies***

1.16.1. Status. The Contractor warrants that any services performed under the terms of the Contract by the Contractor or persons under its employment on FBISD property shall be done as an independent contractor and the persons doing such work shall not be considered employees, agents, joint venturers, or partners of the District. As an independent contractor, Contractor will be solely responsible for determining the means and methods for performing the services and shall furnish all tools, materials, transportation, and personal incidentals necessary in the performance of the services. Contractor shall be responsible for any and all applicable social security and personal income taxes which may become due as a result of any payments made by FBISD and Contractor shall indemnify and hold FBISD harmless in this regard. FBISD and Contractor have no power or authority to assume or create any obligation or responsibility on behalf of the other. Contractor agrees that FBISD has no responsibility for any conduct of any of Contractor's employees, agents, representatives, contractors, or Subcontractors. Contractor shall perform services in accordance with the highest standards of care, skill, diligence and professional competence applicable to contractors engaged in providing similar services.

1.16.2. Price

1.16.2.1. The Contractor warrants the prices offered to the District are no higher than the Contractor's current prices on orders by others for like Deliverables under similar terms of purchase.

1.16.2.2. The Contractor certifies that the prices in the Solicitation Response have been arrived at independently without consultation, communication, or agreement for the purpose of restricting competition, as to any matter relating to such fees with any other firm or with any competitor.

1.16.2.3. In addition to any other remedy available, the District may deduct from any amounts due to the Contractor, and/or otherwise recover from Contractor, any amounts paid by the District for items or services in excess of the Contractor's current prices on orders by others for like Deliverables under similar terms of purchase.

1.16.3. Title

1.16.3.1. The Contractor warrants that it has valid title to all Deliverables furnished under the Contract, and that the Deliverables are free and clear of all liens, claims, security interests and encumbrances.

1.16.3.2. **THE CONTRACTOR SHALL INDEMNIFY AND HOLD THE DISTRICT HARMLESS FROM AND AGAINST ALL ADVERSE TITLE CLAIMS TO THE DELIVERABLES**.

1.16.4. Deliverables

1.16.4.1. The Contractor warrants and represents that all Deliverables shall be free from defects in design, workmanship or manufacture, and conform in all material respects to the specifications, drawings, and descriptions in the Solicitation, to any samples furnished by the Contractor, to the terms, covenants and conditions of the Contract, and to all applicable State, Federal or local laws, rules, and regulations, and industry codes and standards. In addition, Contractor warrants that the Deliverables are suitable for and will perform in accordance with the purposes for which they are intended.

1.16.4.2. Unless otherwise stated in the Solicitation, the Deliverables shall be new or recycled merchandise, and not used or reconditioned. Recycled Deliverables shall be clearly identified as such.

1.16.4.3. Contractor shall assume all liabilities incurred within the scope or consequential damages

and incidental expenses, as set forth in the Contractor or manufacturer's warranties, which result from either delivery or use by the District of the Deliverables with does not meet the specifications of the Contract or the Solicitation.

1.16.5. Warranty Period

1.16.5.1. Unless otherwise specified in the Contract, the warranty period shall be at least one (1) year from the District's acceptance of the Deliverable.

1.16.5.2. If the manufacturer's warranty is less than the required warranty period, the Contractor shall warrant the Deliverable to the full extent as provided by the manufacturer.

1.16.5.3. If during the warranty period, one or more of the above warranties are breached, the Contractor shall promptly, upon receipt of demand, resupply the goods or re-perform the services in accordance with the above standard at no additional cost to the District.

1.16.5.4. All costs incidental to such repair or replacement, including but not limited to, any packaging and shipping costs, shall be borne exclusively by the Contractor.

1.16.5.5. The District will endeavor to give the Contractor written notice of the breach of warranty within thirty (30) days of discovery of the breach of warranty, but failure to give timely notice shall not impair the District's rights under this section.

1.16.6. Failure to Repair or Replace If the Contractor is unable or unwilling to repair or replace defective or non-conforming Deliverables as required by the District, then in addition to any other available remedy, the District may reduce the quantity of Deliverables it may be required to purchase under the Contract from the Contractor, and purchase conforming Deliverables from other sources. In such event, the Contractor shall pay to the District, upon demand, the increased cost, if any, incurred by the District to procure such Deliverables from another source.

Damage Assessment

1.16.6.1. If a Contractor is in default on an order, the District reserves the right to purchase the goods or services in default and charge the increase in price, if any, and cost of handling to the Contractor (the "Damage Assessment").

1.16.6.2. Failure by Contractor to pay a Damage Assessment is cause for Contract termination, at District's sole discretion, and/or debarment of the Contractor from the District's Solicitation list for a minimum of one year.

1.16.7. Transfer of Manufacturer's Warranty

1.16.7.1. If the Contractor is not the manufacturer, and the Deliverables are covered by a separate manufacturer's warranty, the Contractor shall transfer and assign such manufacturer's warranty to the District.

1.16.7.2. If for any reason the manufacturer's warranty cannot be fully transferred to the District, the Contractor shall assist and cooperate with the District to the fullest extent to enforce such manufacturer's warranty for the benefit of the District.

1.16.8. Services The Contractor warrants and represents that all services to be provided the District under the Contract will be fully and timely performed in a good and workmanlike manner in accordance with generally accepted industry standards and practices, the terms, conditions, and covenants of the Contract, and all applicable Federal, State and local laws, rules or regulations.

1.16.9. Limitation of Warranty The Contractor shall not limit, exclude or disclaim the foregoing warranty(ies) or any warranty(ies) implied by law, and any attempt to do so shall be without force or effect.

1.16.10. Delivery of Goods or Performance of Services ***If*** the Contractor is unable or unwilling to deliver goods or perform services in accordance with the terms of the Contract, then in addition to any other available remedy, the District may reduce the amount of the Contract Award due to the Contractor, and purchase conforming goods or services from other sources. In such event, the Contractor shall pay to the District upon demand the increased cost, if any, incurred by the District to procure such goods or services from another source.

1.17. ***Indemnification***

1.17.1. The District shall not be required to indemnify and/or hold harmless the Contractor and/or its agents and employees.

1.17.2. **TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE DISTRICT AND ITS AGENTS, EMPLOYEES, AND TRUSTEES FROM ANY AND ALL CLAIMS, DAMAGES, LOSSES, LIABILITIES, COSTS, SUITS IN LAW OR IN**

EQUITY, FINES, PENALTIES, AND EXPENSES, INCLUDING BUT NOT LIMITED TO ATTORNEY'S FEES, ARISING OUT OF OR RESULTING FROM THE PERFORMANCE OF THE WORK, AND/OR THE ACTS OR OMISSIONS OF CONTRACTOR OR ITS EMPLOYEES , AGENTS, SUBCONTRACTORS, AND/OR ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT IT IS CAUSED IN PART BY A PARTY INDEMNIFIED HEREUNDER, INCLUDING WITHOUT LIMITATION, THOSE ARISING FROM CLAIMED INFRINGEMENT OF ANY PATENT, TRADEMARKS, COPYRIGHT, OR OTHER CORRESPONDING RIGHT(S) RELATED TO ANY ITEM OR SERVICE CONTRACTOR IS REQUIRED TO PERFORM HEREUNDER. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

1.17.3. In any and all claims against the District or any of its agents or employees by any employee of the Contractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor under workers' compensation acts, disability benefits acts or other employee benefit acts.

1.18. ***No Waiver of Immunity*** Contractor acknowledges FBISD is a governmental entity subject to constitutional and statutory protections and immunities. No provision in any contract document shall be construed as a waiver or relinquishment of any governmental immunities or defenses on behalf of FBISD, its trustees, officers, employees, and agents as a result of an award or resulting agreement. Further, any obligation of the District to indemnify or hold harmless is expressly conditioned only to the extent permitted by law.

1.19. ***Invoices and Payment*** The Contractor shall submit separate invoices in duplicate on each Contract Award after each delivery of goods or completion of service. If the District authorizes partial shipments or deliveries it will be shown on the Purchase Order and a separate invoice must be sent for each shipment or delivery made.

1.19.1. Payment to Contractor shall be made only after services are performed and not before. Advance payment to Contractor is strictly prohibited.

1.19.2. Contractor shall submit detailed invoices to FBISD describing the Services rendered, the times when such Services were performed, compensable expenses and the amount due. Invoices shall indicate the FBISD Purchase Order number and shall be itemized and transportation charges, if any, shall be listed separately. A copy of the bill of lading and the freight waybill, when applicable, shall be attached to the invoice. Invoices shall be mailed to FBISD, P.O. Box 1004, Sugar Land, TX 77487-1004, Attention: Accounts Payables Department.

1.19.3. Federal excise taxes, State taxes, or District sales taxes shall not be included in the invoiced amount. The District is not liable for these taxes. The District will furnish a tax exemption certificate upon request.

1.19.4. In accordance with Texas Government Code § 2251.021, payments are due to Contractor within forty-five (45) days after the later of the following: (1) the date the District receives the goods; (2) the date the performance of the service is completed; or (3) the date the District receives an invoice for the goods or services.

1.19.5. Payment terms, including the rate of interest that shall accrue on any overdue payments, are subject to Chapter 2251 of the Texas Government Code.

1.20. ***Right to Assurance***

1.20.1. Whenever one party to the Contract in good faith has reason to question the other party's intent to perform, demand may be made to the other party for written assurance of the intent to perform.

1.20.2. In the event that no assurance is given within the time specified after demand is made, the demanding party may treat this failure as an anticipatory repudiation of the Contract.

1.21. ***Advertising*** The Contractor shall not advertise or publish, without the District's prior written consent, the fact that the District has entered into a Contract with Contractor. Contractor shall not use FBISD's name, logo or other likeness in any press release, marketing material or other announcement without FBISD's prior written approval.

1.23. ***Compliance***: Contractor agrees to observe and abide by all applicable local ordinances and state and federal laws, including but not limited to, the Americans with Disabilities Act; Section 504 of the 1973 Rehabilitation Act; Executive Orders 11246 and 11375 regarding Equal Employment Opportunity, as supplemented in Department of Labor Regulations; the Family Educational Rights & Privacy Act; and Title IX of the Education Amendments of 1972. Contractor further agrees to observe and abide by all FBISD policies and procedures, which can be accessed online at http://pol.tasb.org/Home/Index/483.

2. **CONTRACT AGREEMENTS**

2.1. ***Inclusions***

2.1.1. The Contract shall include these General Provisions, terms and conditions included in the contract, Contract Documents, Purchase Orders and Service Contracts, and supersede any other representations, agreements, arrangements, negotiations, or understanding, oral, or written between FBISD and the Contractor regarding the Contract.

2.1.2. The Solicitation Response, when appropriately accepted by FBISD, shall constitute an integral part of any Contract, equally binding between the Contractor and FBISD. Provided, however, that no different, inconsistent, contradictory, or additional terms included in Contractor's Solicitation Response will become part of this Contract with the exception of Change Orders.

2.2. ***Interpretation***

2.2.1. The Contract Documents are intended by the Contractor and the District as a final, complete and exclusive statement of the terms of their agreement.

2.2.2. No prior arrangements, past performance, oral agreements or other factors between the Contractor and the District shall be relevant to supplement or explain any term used in the Contract Documents.

2.2.3. Although the Contract Documents may have been substantially drafted by one party, it is the intent of the Contractor and the District that all provisions be construed in a manner to be fair to both parties, reading no provisions more strictly against one party or the other.

2.3. ***Jurisdiction and Venue***

2.3.1. The Contract is made under and shall be governed by the laws of the State of Texas, including, when applicable, the Uniform Commercial Code as adopted in Texas, V.T.C.A., Business and Commerce Code, Chapter 1, excluding any rule or principle that would refer to and apply the substantive law of another state or jurisdiction.

2.3.2. All issues arising from the Contract shall be resolved in the courts of Fort Bend County, Texas and the parties agree to submit to the exclusive jurisdiction of such courts.

2.3.3. The foregoing, however, shall not be construed or interpreted to limit or restrict the right or ability of the District to seek and secure injunctive relief from any competent authority as contemplated herein.

2.4. ***Modifications***

2.4.1. The Contract Documents and their terms, covenants and conditions can be modified or amended only in writing, when executed by both parties.

2.4.2. No pre-printed or similar terms on any Contractor invoice, forms, order or other document shall have any force or effect to change the terms, covenants, and conditions of the Contract.

2.5. ***Termination for Default***

2.5.1. In the event of a default by the Contractor, the District shall have the right to terminate the Contract in whole or in part for cause, by written Notice of Termination effective in ten (10) days, unless otherwise specified, after the date of such notice, unless the Contractor, within such ten (10) day period, cures such default, or provides evidence sufficient to prove to the FBISD Buyer's reasonable satisfaction that such default does not, in fact, exist.

2.5.2. In addition to any other remedy available under law or in equity, the District will be entitled to recover all actual damages, costs, losses and expenses, incurred by the District as a result of the Contractor's default, including, without limitation, cost of recovery, reasonable attorneys' fees, court costs, and prejudgment and post judgment interest at the maximum lawful rate.

2.5.3. Additionally, in the event of a default by the Contractor, the District may debar the Contractor from the District's Vendor list.

2.5.4. All rights and remedies under the Contract are cumulative and are not exclusive of any other right or remedy provided by law.

2.6. ***No Cause Termination***

2.6.1. The District also reserves the right to terminate the Contract, with thirty (30) days' advance written notice to Vendor, if the District believes that, in its sole discretion, it is in the best interest of District

to do so. It is understood that the District retains the option to terminate this Agreement for any reason at the end of each contract year without pecuniary risk or penalty. The termination will become effective, and this Agreement shall terminate following the written notification of intent.

2.6.2. The District will pay the Contractor, to the extent of funds appropriated or otherwise legally available for such purposes, for all goods delivered and services performed and obligations reasonably incurred by Contractor prior to the date of termination.

2.7. ***Assignment – Delegation***

2.7.1. The Contract shall be binding upon and to the mutual benefit of the District and the Contractor and their respective successors and assigns, provided however, that no right or interest in the Contract shall be assigned, transferred, subcontracted, mortgaged, pledged, or otherwise disposed of or encumbered in any way by Contractor, and no obligation shall be delegated by the Contractor without the prior written consent of the District.

2.7.2. Any attempted assignment or delegation by the Contractor shall be void unless made in conformity with this paragraph.

2.7.3. The Contract is not intended to confer rights or benefits on any person, firm or entity not a party hereto; it being the intention of the parties that there are no third-party beneficiaries to the Contract.

2.7.4. If the Contractor has sold its business and the Contract is conveyed to another business entity (buyer) in the purchase, the Contractor shall, within three (3) business days of such change, provide the District with documentation that can be legally recognized in a State of Texas court of law, or a public announcement stating the terms of the purchase.

2.9. *Waiver*

2.9.1. No claim or right can be discharged or waived in whole or in part by a waiver or renunciation of the claim or right unless the waiver or renunciation is supported by consideration and is in writing signed by the aggrieved party.

2.9.2. No waiver by either the Contractor or the District to require performance by the other party of the terms hereof shall operate as, or be construed to be, a permanent waiver of any rights or obligations under the Contract, or an express or implied waiver of any other term or breach thereof.

2.10. Captions

2.10.1. The captions herein are for convenience and identification purposes only, and are not an integral part hereof, and are not to be considered in the interpretation of any part hereof.

2.11. Force Majeure

2.11.1. Neither FBISD nor Contractor shall be deemed to have breached any provision of this Contract as a result of any delay, failure in performance, or interruption of service resulting directly or indirectly from acts of God, network failures, acts of civil or military authorities, civil disturbances, wars, energy crise, fires, transportation contingencies, interruptions in third-party telecommunications or Internet equipment or service, other catastrophes, or any other occurrences which are reasonably beyond such party's control.

2.11.2. The parties to this Contract are required to use due caution and preventive measures to protect against the effects of force majeure, and the burden of proving that a force majeure event has occurred shall rest on the party seeking relief under this provision. The party seeking relief due to force majeure is required to promptly notify the other party in writing, citing the details of the force majeure event and relief sought, and shall resume performance immediately after the obstacles to performance caused by a force majeure event have been removed, provided the Contract has not been terminated. Delay or failure of performance, by either party to this Contract, caused solely by a force majeure event, shall be excused for the period of delay caused solely by the force majeure event. Neither party shall have any claim for damages against the other resulting from delays caused solely by force majeure. Notwithstanding any other provision of this Contract, in the event the Contractor's performance of its obligations under this Contract is delayed or stopped by a force majeure event, FBISD shall have the option to terminate the Contract. This section shall not be interpreted as to limit or otherwise modify any of FBISD's contractual, legal, or equitable rights.

2.12. FBISD Property

2.12.1. In the event of loss, damage, or destruction of any property owned by or loaned by FBISD that is caused by Contractor or Contractor's representative, agent, employee, or contractor, Contractor shall indemnify FBISD and pay to FBISD the full value of or the full cost of repair or replacement of such property, whichever is greater, within thirty (30) days of Contractor's receipt of written notice of FBISD's determination of the amount due. If Contractor fails to make timely payment, FBISD may obtain such money from Contractor by any means permitted by law, including, without limitation, offset or counterclaim against any money otherwise due to Contractor by FBISD.

2.13. Notice

2.13.1. Any notice provided under the terms of this Contract by either party to the other shall be in writing and shall be given by hand-delivery or by certified or registered mail, return receipt requested. Notice shall be deemed effective upon receipt. Each party may change the address at which notice may be sent to that party by giving notice of such change to the other party by certified or registered mail, return receipt requested.

2.14. Penalties

2.14.1. If Contractor is unable to provide the goods or services at the prices quoted in Contractor's Solicitation Response or if Contractor fails to fulfill or abide by the terms and conditions of the Contract, FBISD may take the following action(s), in FBISD's sole discretion, and Contractor agrees to comply with FBISD's action(s):

2.14.1.1. insist that Contractor honor the quoted price(s) specified in Contractor's Solicitation Response;

2.14.1.2. have Contractor pay FBISD difference between Contractor's price and the price of the next acceptable Solicitation Response (as determined by FBISD);

2.14.1.3. have Contractor pay the difference between Contractor's price and the actual purchase

price of the good or service on the open market; and/or

2.14.1.4. recommend to FBISD's Board of Trustees that Contractor no longer be given the opportunity to submit a proposal to FBISD and/or that the Contract be terminated.

2.15. Performance

2.15.1. Contractor agrees to use commercially reasonable best efforts to provide the Deliverable(s).

2.16. Performance and Payment Bonds

2.16.1. Contractor agrees to provide performance bonds and/or payment bonds as required by Texas law on specified Contracts and/or projects, as applicable. FBISD may include the performance and payment bonds requirement in the specifications section of any Solicitation if performance bonds and/or payment bonds are required.

2.17. Prevailing Wage Rates

2.17.1. Contractor and all subcontractors of Contractor shall comply with all laws regarding wage rates including, but not limited to, Texas Government Code Chapter 2258 and any related federal requirements applicable to the Contract.

2.18. Title and Risk of Loss

2.18.1. Whenever FBISD is purchasing an item under the Contract, title and risk of loss shall pass upon the later of FBISD's acceptance of the item or payment of the applicable invoice.

2.19. Severability In the event that any one or more of the provisions contained in the Contract shall for any reason be held to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability shall not affect any other provisions, and the Contract shall be construed as if such invalid, illegal, or unenforceable provision had never been contained in it.

2.21. Dispute Resolution Any claim, dispute, or matter in controversy arising out of or related to the award or agreement ("Dispute") shall be discussed by the parties in good faith, in an attempt to resolve the Dispute. In the event such Dispute cannot be resolved by good faith discussion between the parties, any such Dispute shall be subject to FBISD's complaint policy (GF Local or other policy designated by FBISD) and the timelines established in the policy. If a party is dissatisfied with the outcome of FBISD's complaint process, then the Dispute shall be subject to mediation as a condition precedent to litigation.

2.22. Contractor Representations If Contractor is a business entity, it represents that: (i) it is duly organized, validly existing and in good standing under the laws of the state of its organization; (ii) it is authorized and in good standing to conduct business in the State of Texas; (iii) it has all necessary power and has received all necessary approvals to execute and perform its obligations in this Agreement; and (iv) the individual executing this Agreement on behalf of Contractor is authorized to do so.

2.23. Criminal History Certification Contractor shall ensure that its employees who (i) have or will have continuing duties related to the contracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee) have submitted all information necessary for FBISD's LEE Fast Pass process and will comply with any FBISD request for employee information in connection with completing such employee criminal history record search. If Contractor subsequently receives information an employee has a criminal history prohibited under this section, Contractor will immediately remove the employee from contract duties and notify the District in writing within 3 days. Contractor will comply with District objections to the assignment of an employee on the basis of the employee's criminal history. To the extent no individual or employee has or will have direct contact with students, Contractor will ensure the individuals or employees will not have direct contact with students throughout the term of this agreement. Noncompliance or misrepresentation regarding this certification is grounds for immediate termination of this Agreement.

2.24. Conflict of Interest Disclosure Prior to and as a condition of doing business with the District, Contractor shall disclose any business relationship, past or present, with a sitting Board member or District employee. Any such relationship shall be disclosed on Form CIQ provided by the Texas Ethics Commission and currently available at https://www.ethics.state.tx.us/forms/CIQ.pdf. Failure to disclose the existence of any such relationship is grounds for immediate termination of this Agreement.

2.25. Disclosure of Interested Parties (Form 1295) For any agreement that requires action by the District's Board of Trustees, unless excepted by Texas Government Code 2252.908(c), Contractor shall electronically submit a disclosure of interested parties on a form prescribed by the Texas Ethics Commission ("Form 1295") and submit a signed copy of the form with this Agreement. The form is currently available via the Texas Ethics Commission website at https://www.ethics.state.tx.us/tec/1295-Info.htm.

2.26. Felony Conviction Notice Texas Education Code 44.034(a) requires "a person or business entity that enters into a contract with a school district [to] give advance notice to the district if the person or an owner operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony." This notice is not required of a publicly-held corporation. If notice is required of Contractor, then Contractor shall submit a statement providing a person or an owner operator of the business entity has been convicted of a felony and a general description of the conviction and conduct resulting in the conviction of a felony.

2.27. Debarment or Suspension Federal Law (2 CFR Part 180 and Part 200) prohibits non-federal entities from contracting with or making subawards under covered transactions to parties that are suspended or debarred or whose principals are suspended or debarred. Covered transactions include procurement contracts for goods or services equal to or in excess of $25,000 and all nonprocurement transactions (e.g., subawards to subrecipients). Contractor certifies neither Contractor nor its principals are suspended or debarred by a federal agency.

2.28. Entities that Boycott Energy Companies: In accordance with Senate Bill 13, Acts 2021, 87th Leg., R.S., pursuant to Section2274.002 of the Texas Government Code (relating to prohibition on contracts with companies boycotting certain energy companies), Contractor represents and warrants that: it does not, and will not for the duration of the Contract, boycott energy companies. If circumstances relevant to this provision change during the course of the Contract, Contractor shall promptly notify the District.

2.29. Entities that Discriminate Against Firearm and Ammunition Industries: In accordance with Senate Bill 19, Acts 2021, 87th Leg., R.S., pursuant to Section2274.002 of the Texas Government Code (relating to

prohibition on contracts with companies that discriminate against firearm and ammunition industries), Contractor verifies that: it does not, and will not for the duration of the Contract, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association. If circumstances relevant to this provision change during the course of the Contract, Contractor shall promptly notify the District.

3. **GOODS-RELATED CONTRACTS**

3.1. ***General***

3.1.1. Goods are to be delivered to the required destination(s) within the number of District Business Days as identified within the Solicitation after receipt of order (ARO).

3.1.2. All products shall be delivered F.O.B. destination, full freight allowed unless otherwise indicated within the Contract.

3.1.3. Ordering and direct delivery will involve various locations with FBISD unless otherwise specified within the Purchase Order.

3.2. ***Hours for Delivery***

3.2.1. District Distribution Center (warehouse) delivery hours are 8:00 a.m. to 3:30 p.m.

3.2.2 School campus delivery hours are 9:00 a.m. to 3:00 p.m.

3.3. ***Facilities.*** With the exception of the District Distribution Center, no other facilities have areas available dock-level deliveries.

3.4. ***Inside Delivery*** The Contractor shall make inside deliveries within a facility to a location determined by the District if required within the Solicitation.

3.5. ***Expedited Deliveries***

3.5.1. In case of an urgent need for an expedited delivery by the District, the Contractor is requested to supply the needed material immediately, if possible.

3.5.2. If the Contractor cannot respond, then the emergency requirement may be purchased on the open market. Such purchases shall not be considered a breach of Contract by FBISD or the Contractor.

3.6. ***Packaging of Goods***

3.6.1. The Contractor shall package all goods in accordance with good commercial practice unless otherwise instructed.

3.6.2. Each shipping container shall be clearly and permanently marked as follows:

3.6.2.1. The Contractor's name and address.

3.6.2.2. The District's name, address and purchase order or purchase release number if applicable;

3.6.2.3. Box number and total number of boxes, e.g. box 1 of 4 boxes; and

3.6.2.4. The number of the container bearing the packing slip. The Contractor shall bear all cost of packaging.

3.6.3. All packing slips must include the FBISD Purchase Order number.

3.6.4. Goods shall be suitably packed to secure lowest transportation costs and to conform to requirements of common carriers and any applicable specifications. The District's count or weight shall be final and conclusive on shipments not accompanied by packing lists.

3.7. ***Material Safety Data Sheets*** A Contractor must provide, at no cost to the District, at least one copy of any applicable Manufacturer's Material Safety Data Sheet(s) (MSDS) with each shipment, and upon request, during the term of the Contract. If OSHA or Federal or State laws provide for additional requirements, those requirements shall be met by Contractor, in addition to the MSDS requirement.

3.8. ***Inspection and Testing***

3.8.1. The District expressly reserves all rights under law, including but not limited to the Texas Business and Commerce Code, to inspect the Deliverables at delivery, and up to thirty (30) days after District's first use of the Deliverables, and to reject defective or non-conforming Deliverables.

3.8.2. All goods are subject to inspection and testing by FBISD for compliance with the Contract and/or Solicitation specifications by FBISD.

3.8.3. When products tested fail to meet or exceed all applicable specifications, the cost of the sample used and the cost of any testing shall be borne by the Contractor.

3.8.4. Goods, which have been delivered and rejected in whole or in part, may be, at FBISD's option, returned to the Contractor at Contractor's risk and expense or disposed of in accordance with FBISD's policies.

3.8.5. The Contractor may request that rejected goods be held by FBISD at Contractor's risk for a

reasonable period of time for later disposition at the Contractor's expense.

3.8.6. Latent defects may result in revocation of acceptance of any product.

3.9. ***Substitutions of Goods***

3.9.1. All substitutions of goods require prior written approval of the District.

3.9.2. The District reserves the right to require the Contractor to offer possible substitutes if any material or equipment becomes unobtainable during the term of the Contract.

3.9.3. Outstanding orders are not automatically amended by an approved substitution.

3.9.4. During the Contract term, Contractor may request a substitution of an item if the item is no longer manufactured or has been discontinued or superseded by a replacement model and is no longer available to the Contractor.

3.9.5. Substitution Approval Process. Under the forgoing or similar conditions, the Contractor may, in FBISD's sole discretion, be granted an allowance of an item substitution under the following conditions:

3.9.5.1. The Contractor provides the District Purchasing Office with written verification from the manufacturer that the product is no longer manufactured or has been discontinued or superseded by a replacement model and is no longer available to the Contractor.

3.9.5.2. All substitution requests must be submitted within ten (10) District Business Days after the material facts are known to Contractor.

3.9.5.3. If manufacturer has a substitution model, Contractor must provide product specifications along with a written letter requesting the item be substituted.

3.9.5.4. The substitution must meet or exceed all specification requirements associated with the original Solicitation.

3.9.5.5. If substitutions are made to an item that has accessories, the Contractor must also provide substitutions for accessories as applicable.

3.9.5.6. The Contractor will be expected to supply the substitute item at the same or better price than originally bid, unless the Solicitation provided a price increase provision and the substitute can meet the provision requirements.

3.9.5.7. Substitution will be in effect for the term of the Contract or until another substitution is required.

3.9.5.8. All substitutions must be approved in writing by the Purchasing Office prior to their effect.

3.9.5.9. The District reserves the right to approve and disapprove substitutions or to cancel the Contract or Purchase Order as it relates to the items in its entirety and procure the items by a separate procurement process.

3.10. ***Electrical Items*** All electrical items furnished shall meet all applicable OSHA standards and regulations and bear the appropriate listing from UL, FMRC or NEMA.

4. **SERVICE-RELATED CONTRACTS**

4.1. ***Contractor's Obligations***. The Contractor shall fully and timely provide all Deliverables described in the Contract, Solicitation, and in the Vendor's Solicitation Response in strict accordance with the terms, covenants, and conditions of the Contract and all applicable Federal, State, and local laws, rules, and regulations.

4.2. ***Competence of Contractor***

4.2.1. The Contractor warrants it shall have available the necessary personnel, organization, equipment, and facilities to perform all the services and/or provide all the goods required under a Purchase Order or this Contract.

4.2.2. Only qualified personnel adequately trained in the required services shall be employed by the Contractor.

4.2.3. The Contractor shall obtain all licenses/permits required for the performance of the services.

4.2.4. The Contractor shall employ only orderly and competent workers, skilled in the performance of the services which they will perform under the Contract.

4.2.5. The Contractor, its employees, Subcontractors, and Subcontractor's employees may not use or possess any firearms, alcoholic or other intoxicating beverages, tobacco, illegal drugs or controlled substances while on the job or on the District's property, nor may such workers be intoxicated, or under the influence of alcohol or drugs on the job.

4.2.6. The District reserves the right to prevent, forbid, and/or temporarily or permanently bar any of Contractor's employees, Subcontractors, or Subcontractor's employees from any District facility for whatever reason it determines necessary to maintain the safety, decorum, scheduling and day-to-

day operations of the District.

4.3. ***Licensing and Certification***

4.3.1. If the Contract requires licensing and/or certification to perform services as required, the Contractor shall provide only qualified licensed / certified individuals to perform such tasks.

4.3.2. The Contractor must maintain any required licenses / certification for the duration of the Contract.

4.3.3. The District reserves the right to require the Contractor to show proof of licensing / certification at any time during the Contract Term.

4.4. ***Place and Condition of Work***

4.4.1. Services shall be provided/scheduled as specified or directed by the District.

4.4.2. The District shall provide the Contractor access to the sites where the Contractor is to provide the goods or perform the services as required.

4.4.3. The Contractor acknowledges that it has satisfied itself as to the nature of the District's service requirements and specifications, the location and essential characteristics of the work site(s) the quality and quantity of materials, equipment, labor and facilities necessary to provide the goods or perform the services, and any other condition or state of fact which could in any way affect performance of the Contractor's obligations under the Contract.

4.4.4. The Contractor releases and holds the District harmless from and against any liability or claim for damages of any kind or nature if the actual site or service conditions differ from expected conditions.

4.5. ***Compliance with Laws and Safety Regulations***

4.5.1. The Contractor, its Subcontractors, and their respective employees, shall comply fully with all applicable federal, state, and local safety and health laws, ordinances, rules and regulations in the performance of the services, including but not limited to those imposed by the District and by the Occupational Safety and Health Administration (OSHA), as well as applicable workers' compensation laws, minimum and maximum salary and wage statutes and regulations, prompt payment and licensing laws and regulations.

4.5.2. In case of conflict, the most stringent safety requirements shall govern.

4.5.3. The Contractor shall indemnify and hold the District harmless from and against all claims, demands, suits, actions, judgments, fines, penalties and liability of every kind arising from the breach of the Contractor's obligations under this paragraph.

4.6. ***Security and Background Investigations***

4.6.1. Prior to commencing any work under the Contract, if Contractor contracts with FBISD to provide services, Contractor must certify for each covered employee of Contractor who will have direct contact with students, Contractor has obtained, as required by Texas Education Code Section 22.0834: (a) state criminal history record information from a law enforcement or criminal justice agency or a private entity that is a consumer reporting agency governed by the Fair Credit Reporting Act (15 U.S.C. Section 1681 et seq.) for each covered employee of Contractor employed before January 1, 2008; and (b) national criminal history record information for each employee of Contractor employed on or after January 1, 2008. Contractor must also obtain similar certifications of compliance with Texas Education Code Chapter 22's requirements from any subcontractors on the form provided herein. Covered employees with disqualifying criminal history are prohibited from serving at FBISD; Contractor and any subcontracting entity may not permit a covered employee to provide services at a school if the employee has been convicted of a felony or misdemeanor offense that would prevent a person from being employed under Tex. Educ. Code § 22.085(a) (i.e., Title 5 felony or an offense requiring registration as a sex offender and victim was under 18 years of age or was enrolled in a public school at the time the offense occurred).

4.6.2. The Contractor shall be responsible for ensuring the District is protected from potential threats that may be created by their employees.

4.6.3. If directed by the laws of the State of Texas, the Contractor shall adhere to any requirements that may be legislated during the term of any Contract, or any enacted District policy.

4.6.4. The District will have the right to require Contractor's principles, Contractor's employees assigned to the Contract Award, Subcontractor's principles, and Subcontractor's employees assigned to the Contract, and any other individuals deemed to be providing goods or services for the District to be investigated (including fingerprinting) for criminal records and/or history.

4.6.5. The District reserves the right to prevent, forbid, and/or temporarily or permanently bar Contractor, Contractor's employees, Subcontractors, or Subcontractor's employees from any District facility for

whatever security reason it determines necessary to maintain the safety of District employees and operations.

4.7. ***Subcontracts*** Where a Subcontract may be used, the Contractor shall be fully responsible to the District for all acts and omissions of the Subcontracts just as the Contractor is responsible for the Contractor's own acts and omissions. Nothing in the Contract shall create for the benefit of any such Subcontract any Contractual relationship between the District and any such Subcontract, nor shall it create any obligation on the part of the District to pay or to see to the payment of any moneys due any such Subcontract except as may otherwise be required by law.

4.8. ***District Policy for Work Attire***. The Contractor, its employees, and Subcontractor employees shall not wear any T-shirts or clothing that has offensive language, pictures, or signs. The District prefers Contractors, its employees and subcontractors to wear uniforms with identification badges when on District premises.

4.9. ***Insurance for Services Performed***

4.9.1. ACORD Certificate of Insurance. Prior to providing services as a result of a Contract Award, the Contractor shall provide the District with a completed ACORD Certificate of Insurance providing the below listed coverage or such coverage as may be required in the Solicitation.

Type	Limit
Automobile Liability (Auto) - Covering 'Any Auto'	$1,000,000 Combined Single Limit ($5,000,000 if "For-Hire" motor carrier service)
Comprehensive General Liability (CGL) Including Products, Completed Operations, Independent Contractors, Broad Form Property Damage, Pollution and Blanket Contractual Liability coverages. XCU exclusions to be removed when underground work is performed.	$1,000,000 Occurrence $2,000,000 Aggregate $1,000,000 Personal Injury $ 500,000 Fire Damage $ 5,000 Medical Payments
Professional Errors & Omissions Liability (E & O) may be required from all contractors and licensed or certified as professionals; e.g., engineers, architects, insurance agents, physicians, attorneys, banks, financial consultants, etc.	One-time project amount. $1,000,000 Occurrence and Aggregate minimum $5,000,000 Maximum Limit Retroactive Date preceding date of contract must be shown Extended Reporting Period three (3) years past completion
Workers' Compensation (WC) Limits to comply with the requirements of the Texas Workers' Compensation Act Employers Liability	Statutory Limits $1,000,000
Umbrella or Excess Liability Excess of primary General Liability, Automobile Liability and WC Coverage B May be required for prime construction contractors May be required for non-construction contractors and licensed or certified as professionals; e.g., engineers, architects, insurance agents, physicians, attorneys, banks, financial consultants, etc.	 100% of Contract Amount for all contracts exceeding $100,000, up to $25,000,000 max $5,000,000
Sex Molestation/Abuse Required when service performance permits direct, unsupervised access to students.	$100,000 per claim/$300,000 aggregate

Cyber/Data Liability Required if service involves use of *or* access to District-owned data. Coverage for Notification, Crisis Management, Regulatory Response and Privacy Liability.	Limit determined on per project basis.

4.9.2. **Insurance Conditions** All certificates must include:

1) The location or description and the bid number, CSP number or Purchase Order number
2) A 30 day notice of cancellation of any non-renewal, cancellation or material change to any of the policies
3) Additional Insured on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District.
4) A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies.
5) In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the District as Additional Insured, and (b) showing waivers of subrogation in favor of the District: CG2010, CG2037, CG2404, CA0070, CA0032, WC0003 or their equivalents.
6) Contractor shall not commence work until all required insurance coverages have been obtained and such insurance has been reviewed and accepted by the District. Certificates of Insurance on the current ACORD form shall be issued to the District showing all required insurance coverages.
7) All insurance coverages shall be issued on an Occurrence basis (except Professional Liability) by companies acceptable to District and licensed to do business in the State of Texas by the Texas Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".
8) The District reserves the right to review the insurance requirements during the effective period of any contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.
9) Limits for primary policies may differ from those shown when Umbrella or Excess Liability insurance is provided.
10) Contractor shall be responsible for payment of all deductibles.
11) At any time during the Contract Term or any extensions thereof, prior to any lapse in the Certificate of Insurance, the Contractor shall provide to the District an updated certificate.

4.10. ***Right to Audit*** The District will have the right to audit the Contractor's books and records pertaining to all goods and services, and Contractor's compliance with the terms of the Contract, during the hours of the normal workday during the term of the Contract and for a period of five (5) years following expiration of the Contract.

SECTION AC
PACKAGE "A" BASE BID PROPOSAL FORM – CSP STIPULATED SUM

CSP No: 25-009AL **BP** 031 - **BP Name:** Bush HS Renovations

FORT BEND INDEPENDENT SCHOOL DISTRICT

Submitted by: _____

Date: _____ Phone Number: _____

Vendors are required to respond to <u>all</u> requests identified in the Solicitation and indicate their acceptance or objection to the terms of the Solicitation and these General Provsisions must be clearly indicated in Vendor's Solicatiation Response. No-bid is deemed non-responsive by FBISD.

Having examined Proposal and Contract Documents prepared by Fort Bend ISD and Stantec Architecture dated 2/21/2025 and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

I. DESCRIPTION: The scope of work consists of renovation and expansion project at Bush HS. This project encompasses several key areas like the Auditorium and support spaces, Black Box and existing Fine Arts Suite. This renovation includes Mechanical, Audio visual, Lighting, Finishes upgrades and the construction of the New Fine Arts Building Addition incorporating its surrounding site work.

Undersigned agrees to complete the work for the lump sum amounts of:

_____Dollars
(Amount written in words governs)

$_____
(Amount in figures)

II. PROJECT TIMELINES

The District anticipates that this project will take 767 calendar days to complete. Contractor agrees the work will be substantially completed within 767 calendar days from executed contract and issuance of Notice to Proceed.

Should the Contractor anticipate **lower** calendar days to complete this project, please indicate below. The District will consider contractor proposed lower calendar days and incorporate into contract if deemed appropriate.

CONTRACTOR'S PROPOSED DAYS TO COMPLETE BP 031_____

III. LIQUIDATED DAMAGES:

The undersigned understands that liquidated damages as defined in the Supplementary Conditions will be included in the form of Agreement Between Owner and Contractor and that the contractor will be bound thereto.

Contractor accepts the provisions of the Contract as to liquidated damages in the event of failure to complete the work on time. Liquidated damages shall be the sum of **$1,000.00** per day for each calendar day that Substantial Completion is delayed for each project.

Further, the Contractor acknowledges that additional liquidated damages in the sum of **$250.00** per day for each calendar day shall be imposed for non-completion of punch list items and contract close-out within sixty (60) calendar days after Substantial Completion.

IV. ALLOWANCES:

Allowances are to be included in the Contractor's base bid for each project in the following amounts:

A. $N/A NOT USED
B. $N/A NOT USED

Contractor should include allowance and markup in the base bid. Section 3.8 of the Supplementary Conditions defines the procedures for markups.

V. UNIT PRICES – BASE BID

UNIT PRICES – FOUNDATION

A. Provide unit pricing for straight shaft drilled piers in lieu of drilled bell bottom piers –same depth as indicated on the Drawings:

01	☐18" Diameter	_____	Each (EA)
02	☐20" Diameter	_____	Each (EA)
03	☐22" Diameter	_____	Each (EA)
04	☐24" Diameter	_____	Each (EA)
05	☐26" Diameter	_____	Each (EA)
06	☐28" Diameter	_____	Each (EA)
07	☐30" Diameter	_____	Each (EA)
08	☐32" Diameter	_____	Each (EA)

B. Provide unit pricing for auger cast piling:

UNIT PRICES – SITE CONCRETE

A. Provide unit pricing for the following site concrete work:

01	☐ Add/Delete 60" Wide Sidewalks	_____	Lin. Foot (LF)
02	☐ Add/Delete Non-Traffic Concrete Flatwork	_____	Sq. Foot (SF)
03	☐ Add/Delete Med. Duty (5") Concrete Paving	_____	Sq. Foot (SF)
04	☐ Add/Delete Heavy Duty (7") Concrete Paving	_____	Sq. Foot (SF)
05	☐ Add/Delete 6" Concrete Curb	_____	Lin. Foot (LF)

UNIT PRICES – ELECTRICAL POWER
Provide unit pricing for the following electrical power work:

01 ☐Add/Delete Contractor generated power to the site/project (in the absence of CenterPoint power availability). _____ Per Month

UNIT PRICES – ELECTRICAL POWER Provide unit pricing for the following electrical work:

01	☐ Add/Delete 120V Duplex Rec. On Nearby Circuit	_____ Each (EA)
02	☐ Add/Delete 120V Duplex Rec. On Dedicated Circuit, including 20 amp circuit breaker	_____ Each (EA)
03	☐ Add/Delete 220V Rec. On Dedicated Circuit including 20 amp circuit breaker	_____ Each (EA)
04	☐ Add/Delete Two-Way Light Switch	_____ Each (EA)
05	☐ Add/Delete Two-Way Light Switch	_____ Each (EA)
06	☐ Add/Delete J-Box with 1-1/4" Conduit stubbed to above ceiling	_____ Each (EA)

UNIT PRICES – DATA
Provide unit pricing for the following electrical work:

01 ☐Add/Delete Data Port Wired to Nearest IDF/MDF _____Each (EA)

VI. CHANGES IN THE WORK

The undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VII. PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The proposer further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, acceptance or rejection of any proposals, and recommendation or award of the contract.

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in Receipt of Proposals.

The undersigned certifies that the amounts contained in this Competitive Sealed Proposal have been carefully checked and are submitted as correct and final; and additionally, agrees to comply with all provisions of the Proposal Form.

The undersigned CONTRACTOR proposes and agrees, if this Proposal is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Proposal and in accordance with the Contract Documents.

CONTRACTOR accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Proposal Security. This Proposal will remain open for sixty (60) days after the day of Proposal opening. CONTRACTOR will sign the Agreement and submit the Contract Security and other documents required by the Contract documents within ten (10) calendar days after the date of the OWNER'S Notice of Award.

In submitting this Proposal, CONTRACTOR represents, as more fully set forth in the Agreement, that:

(a) Contractor has examined copies of all the Contract Documents and of the following addenda, receipt of which is hereby acknowledged, and also copies of the Advertisement or Invitation to Submit Proposal.

_____ **ADD-01** dated _____ Total # pgs_____ **ADD-02** dated _____ Total # pgs_____
_____ **ADD-03** dated _____ Total # pgs_____ **ADD-04** dated _____ Total # pgs_____
_____ **ADD-05** dated _____ Total # pgs_____ **ADD-06** dated _____ Total # pgs_____
_____ **ADD-07** dated _____ Total # pgs_____ **ADD-08** dated _____ Total # pgs_____

(b) CONTRACTOR has examined the site and locality where the work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions effecting cost, progress or performance of the work and has made such independent investigations as CONTRACTOR deems necessary.

(c) This PROPOSAL is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; CONTRACTOR has not directly or indirectly induced or solicited any other Contractor to submit a false or sham Proposal; CONTRACTOR has not solicited or induced any person, firm or a corporation to refrain from submitting a proposal; and CONTRACTOR has not sought by collusion to obtain for himself any advantage over any other Contractor or over OWNER.

Type of Proposer's Organization:

_____
(Corporation, Co-Partnership, Individual, etc.)

Proposer: _____
(Print or Type)

_____
Signature of Proposer

Title of Office: _____
(Print or Type)

Legal Address: _____
(Print or Type)

_____

Zip Code: _____ Tel:(_____) _____
(Print or Type)

ATTEST:

_____
(Secretary, if Proposer is a Corporation

SEAL:
(If Corporation)

SECTION AC
PACKAGE "B" ALTERNATE BID PROPOSAL FORM – CSP STIPULATED SUM

CSP No: 25-009AL **BP**031 **BP Name:** Bush HS Renovations

FORT BEND INDEPENDENT SCHOOL DISTRICT

Submitted by: _____

Date: _____ Phone Number: _____

Vendors are required to respond to all requests identified in the Solicitation and indicate their acceptance or objection to the terms of the Solicitation and these General Provisions must be clearly indicated in Vendor's Solicitation Response. No-bid is deemed non-responsive by FBISD.

Having examined Proposal and Contract Documents prepared by Fort Bend ISD and Stantec Architecture dated 2/21/2025 and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

I. DESCRIPTION: The scope of work consists of renovation and expansion project at Bush HS. This project encompasses several key areas like the Auditorium and support spaces, Black Box and existing Fine Arts Suite. This renovation includes Mechanical, Audio visual, Lighting, Finishes upgrades and the construction of the New Fine Arts Building Addition incorporating its surrounding site work.

Undersigned agrees to complete the work for the lump sum amounts of:

_____Dollars
(Amount written in words governs)

$_____
(Amount in figures)

II. PROJECT TIMELINES – Refer to Section V. for the construction calendar days associated with alternates.

The District anticipates that this project will take 767 calendar days to complete. Contractor agrees the work will be substantially completed within 767 calendar days from executed contract and issuance of Notice to Proceed.

Should the Contractor anticipate **lower** calendar days to complete this project, please indicate below. The District will consider contractor proposed lower calendar days and incorporate into contract if deemed appropriate.

CONTRACTOR'S PROPOSED DAYS TO COMPLETE
BP 031 _____ Base Proposal

BP 031 _____ Alternates
BP 031 _____ Base Proposal and Alternates

(Enter only if LOWER than District's proposed time)

III. LIQUIDATED DAMAGES:

The undersigned understands that liquidated damages as defined in the Supplementary Conditions will be included in the form of Agreement Between Owner and Contractor and that the contractor will be bound thereto.

Contractor accepts the provisions of the Contract as to liquidated damages in the event of failure to complete the work on time. Liquidated damages shall be the sum of **$1,000.00** per day for each calendar day that Substantial Completion is delayed for each project.

Further, the Contractor acknowledges that additional liquidated damages in the sum of **$250.00** per day for each calendar day shall be imposed for non-completion of punch list items and contract close-out within sixty (60) calendar days after Substantial Completion.

IV. ALLOWANCES:

Allowances are to be included in the Contractor's base bid for each project in the following amounts:

A. $N/A NOT USED
B. $ N/A NOT USED

Contractor should include allowance and markup in the base bid. Section 3.8 of the Supplementary Conditions defines the procedures for markups.

V. ALTERNATES

Refer to Division 01 23 00 for administrative and procedural requirements of Alternates.

Alternate No. 1 Base Bid Adjustment

The undersigned agrees to complete all base bid work and adjust the final base bid lump sum amount as follows:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐
2. _____ Dollars
   (Amount written in words governs)

   $_____
   Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:

   _____

Alternate No. 2 Deviations Request Form

If Bidder proposes to use any substitution or deviations from the base bid use Alternate No. 2 via the Deviations Form in section 00 21 13 Instructions to Bidders. If the owner elects to proceed with Alternate No. 2, the undersigned agrees to complete the ADDITIVE work for the lump sum amount of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐
2. _____Dollars
   (Amount written in words governs)

   $_____
   Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:

   _____

Alternate No. 3 Chiller Manufacturer Alternates. (No chillers included in the base bid)

The bidding contractor shall provide three different manufacturers as add alternates.

The Owner will select one of the three Chiller Manufacturer Alternates (Alt 3A, 3B or 3C)

Alternate 3A shall be JCI/York as basis of design.

If the owner elects to proceed with Alternate No. 3A
the undersigned agrees to complete the ADDITIVE work for the lump sum amounts of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐
2. _____Dollars
   (Amount written in words governs)

   $_____
   Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:

   _____

Alternate 3B shall be Carrier as basis of design.

If the owner elects to proceed with Alternate No. 3B
the undersigned agrees to complete the ADDITIVE work for the lump sum amounts of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐
2. _____Dollars
   (Amount written in words governs)

   $_____
   Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:

   _____

Alternate 3C shall be Daikin as basis of design.
If the owner elects to proceed with Alternate No. 3C
the undersigned agrees to complete the ADDITIVE work for the lump sum amounts of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐
2. _____Dollars
(Amount written in words governs)

$_____
Amount written in figures

3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:
_____

Alternate No. 4 Auditorium Power Distribution and Control Console
Replace existing power receptacle devices in the Auditorium and over the Stage with new equipment and provide control console accessories for remote operation.

If the owner elects to proceed with Alternate No. 4 the undersigned agrees to complete the ADDITIVE work for the lump sum amounts of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐

_____Dollars
(Amount written in words governs)

$_____
2. Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:
_____

Alternate No. 5 Black Box Power Distribution
Replace existing power receptacle devices mounted to the pipe grid with new equipment.

If the owner elects to proceed with Alternate No. 5 the undersigned agrees to complete the ADDITIVE work for the lump sum amounts of:

1. Add ☐ Deduct ☐ No Change ☐ Not Applicable ☐

_____Dollars
(Amount written in words governs)

$_____
2. Amount written in figures
3. Add ☐ Deduct ☐ No. of calendar days to adjust the Contract Time for this alternate:
_____

VI. UNIT PRICES – ALTERNATE BID

UNIT PRICES – On Base Bid Form

VII. CHANGES IN THE WORK

The undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VIII. PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The proposer further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, acceptance or rejection of any proposals, and recommendation or award of the contract.

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in Receipt of Proposals.

The undersigned certifies that the amounts contained in this Competitive Sealed Proposal have been carefully checked and are submitted as correct and final; and additionally, agrees to comply with all provisions of the Proposal Form.

The undersigned CONTRACTOR proposes and agrees, if this Proposal is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Proposal and in accordance with the Contract Documents.

CONTRACTOR accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Proposal Security. This Proposal will remain open for sixty (60) days after the day of Proposal opening. CONTRACTOR will sign the Agreement and submit the Contract Security and other documents required by the Contract documents within ten (10) calendar days after the date of the OWNER'S Notice of Award.

In submitting this Proposal, CONTRACTOR represents, as more fully set forth in the Agreement, that:

(a) Contractor has examined copies of all the Contract Documents and of the following addenda, receipt of which is hereby acknowledged, and also copies of the Advertisement or Invitation to Submit Proposal.

_____ **ADD-01** dated _____ Total # pgs_____ **ADD-02** dated _____ Total # pgs_____

_____ **ADD-03** dated _____ Total # pgs_____ **ADD-04** dated _____ Total # pgs_____

_____ **ADD-05** dated _____ Total # pgs_____ **ADD-06** dated _____ Total # pgs_____

_____ **ADD-07** dated _____ Total # pgs_____ **ADD-08** dated _____ Total # pgs_____

(b) CONTRACTOR has examined the site and locality where the work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions effecting cost, progress or performance of the work and has made such independent investigations as CONTRACTOR deems necessary.

(c) This PROPOSAL is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; CONTRACTOR has not directly or indirectly induced or solicited any other Contractor to submit a false or sham Proposal; CONTRACTOR has not solicited or induced any person, firm or a corporation to refrain from submitting a proposal; and CONTRACTOR has not sought by collusion to obtain for himself any advantage over any other Contractor or over OWNER.

Type of Proposer's Organization:

_____

(Corporation, Co-Partnership, Individual, etc.)

Proposer: _____

(Print or Type)

_____

Signature of Proposer

Title of Office: _____

(Print or Type)

Legal Address: _____

(Print or Type)

_____

Zip Code: _____ Tel:(_____) _____

(Print or Type)

ATTEST:

_____

(Secretary, if Proposer is a Corporation

RETURN THIS DOCUMENT IN CSP BID/PROPOSAL PACKAGE

SEAL:
(If Corporation)

Clarification for Package B of Fort Bend ISD CSP

Package A – Base Bid and All Documents EXCEPT Alternates and SBE Documents

Package A should include the contractor's base bid for the project on the Base Bid Form

Package B – Alternates and Base Bid Adjustment (correction)

Package B should include the following on the Alternate Form:

- The bidder's **alternate bids** as requested by the District. If a bidder does not submit alternate pricing, they will be disqualified as a non-responsive bidder.

- The bidder's **base bid adjustment** to their original base bid submitted in Package A.

- **Deviations** should not be included in the base bid or base bid adjustment.

  Bidder should enter the amount the District may ADD to or DEDUCT from their base bid submitted in Package A. For example, if the bidder submitted a base bid in Package A as $10,000,000 but realized they should have submitted the base bid as $10,500,000, then the bidder would insert an ADD in the Base Bid Adjustment line as $500,000.

  The **Purchasing Department** will calculate Base Bid (Package A) plus/minus Base Bid Adjustment (Package B) to obtain the FINAL Base Bid for the CSP.

- No deviations are allowed in the base bid or base bid adjustment. Any deviation from the Base
- Bid shall be submitted as Alternate No. 2 on the Deviations Form. Evaluation of the proposed substitutes/deviations does not constitute Owner's acceptance of the substitutes/deviations but can be considered during negotiations

  Form Instructions:

  Add: Provides the amount Purchasing should add to the original base bid reflected in Package A

  Deduct: Provides the amount Purchasing should deduct from the original base bid reflected in Package A

  No change: Means that there is no change to your base bid price reflected in Package A

  Not Applicable (NA): Means that there is no change to your base bid price reflected in Package A

Statute / District Required Forms:

- **No Response Form** ***(Optional)***
- **Contractor Informational Form** ***(Required)***
- **Contractor Questionnaire** ***(Required)***
- **Bonding Capacity Certification Letter** ***(Required)***
- **Proposal Submission Form** ***(Required)***
- **Non-Collusion Certification** ***(Required)***
- **Certificate of Residency** ***(Required)***
- **Affidavit of Non-Discriminatory Employment** ***(Required)***
- **Contractor Certification** ***(Required)***
- **Felony Conviction Notification** ***(Required)***
- **Vendor Debarment Statement** ***(Required)***
- **Conflict of Interest Questionnaire** ***(Required)***
- **Certification regarding Lobbying** ***(Required)***
- **Confidential Copyrighted Information** ***(Required)***
- **Owner(s) Name of Business** ***(Required)***
- **Delinquent Taxpayers** ***(Required)***
- **Fort Bend ISD Contractor and Subcontractor Participation Form** ***(submit with SBE Requirements)***
- **Certificate of Interested Parties** ***(Required)***
    - **INSTRUCTIONS for Form 1295 (Certificate of Interested Parties)**
- **Forms Certification** ***(Required)***
- **Per Govt. Code 2270.002, written verification that the company does not boycott Israel and will not during the term of the contract** ***(Required)***
- **Addendum Acknowledgment Form (*Required*)**

No Response Form *(Optional)*

RETURN ONLY IF YOU CHOOSE NOT TO SUBMIT A RESPONSE TO THIS SOLICITATION

CSP _____

TITLE of CSP _____

Please Print

Whereas on the _____ day of _____, 2024 (print name of company)

_____

has reviewed FBISD's solicitation and elects not to submit a bid:

State Reason for no bid:_____

_____

_____

_____

Street Address

_____

City, State, Zip Code

_____

Telephone/Fax Number

_____

Name of Authorized Individual

_____

Signature of Authorized Individual

Contractor Informational Form *(Required)*

CONTRACTOR IS:

An Individual

By _____
Individual's Name

A Partnership

_____
Firm Name

By_____
General Partner Authorized to Sign

A Corporation

By_____
Corporation Name

_____
State of Incorporation

By_____
Name of Person Authorized to Sign

_____
Title

(Corporate Seal)

Attest_____
Secretary

Contractor Questionnaire *(Required)*

Bidder:_____

1. Are you using subcontractors? Yes_____No____

2. Have you ever performed work for Fort Bend ISD or other ISDs as a subcontractor? Yes _____ No_____. If the answer is yes, please provide name of Contractor and Project(s) you were subcontracted to.

   _____

   _____

   _____

3. Can you provide proof of liability and worker's compensation coverage? Yes_____No_____

4. Did you include the most recent up to date references in this packet? Yes_____ No_____

5. Please include similar projects that you have completed for Texas ISDs in the past 12 months.

   _____

   _____

   _____

   _____

PROPOSAL SUBMISSION FORM

CSP _____

Title of CSP_____

Please Print

Whereas on the _____ day of _____, 2024

(print name of company) _____ has reviewed

CSP # _____

A copy may be obtained at http://www.fortbendisd.com/docs/purchasing/general-provisions-for-purchasing-solicitations-and-contracts.pdf or by contacting the Fort Bend ISD Buyer listed on the cover sheet. Any exception to the terms and conditions must be included in the Proposer's response.

Texas Education Code 44.031(a)(5); Texas Government Code 2269
***Purchasing and Acquisition,* FBISD Policy CH (Legal)**
***Purchasing and Acquisition,* FBISD Policy CH (Local)**
***Facilities and Construction,* FBISD Policy CV (Legal)**
***Facilities and Construction,* FBISD Policy CV (Local)**

_____	_____
Street Address	***City, State, Zip Code***
_____	_____
Telephone Number	***Fax Number***
_____	_____
Name of Authorized Individual	***Signature of Authorized Individual***

Non-Collusion Certification *(Required)*

The undersigned affirms that he or she is duly authorized to execute this questionnaire, that this company, corporation, firm, partnership, or individual has not prepared this submission in collusion with any other person, firm, or entity making or considering making a submission to FBISD for any of the future District projects, and that the contents of this submission as to prices, terms or conditions of said submission have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this submission.

The foregoing is true and correct. FBISD, or any authorized representative of FBISD, is authorized by the undersigned to contact any firm, institution, or person listed above to obtain information which FBISD might determine as being desirable.

Firm: _____

Address: _____

City/State/Zip: _____

Phone No: _____

Fax No: _____

Signature: _____

Typed Name: _____

Date: _____

Certificate of Residency *(Required)*

The State of Texas has passed a law concerning non-resident contractors. This law can be found in Texas Government Code under Chapter 2252, This law makes it necessary for FBISD to determine the residency of its proposers. In part, this law reads as follows:

"Section: 2252.001
(3) 'Non-resident bidder' refers to a person who is not a resident.

(4) 'Resident bidder' refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Section: 2252.002
A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located."

I certify that _____
(Name of Company Bidding)

is, under Section: 2252.002, 003 and 004, a

_____ Resident Bidder _____ Non-resident Bidder

My or Our principal place of business under Section: 2252.002, 003, and 004, is in the city of

_____ in the state of _____

_____
Signature of Authorized Company Representative

_____
Print Name

_____ _____
Title Date

Affidavit of Non-Discriminatory Employment *(Required)*

(Tracking purposes only)

FORT BEND INDEPENDENT SCHOOL DISTRICT

This company, Contractor, or Subcontractor agrees to refrain from discrimination in terms and conditions of employment on the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and rules and regulations issued pursuant thereto in order to maintain and insure non-discriminatory employment practices.

_____

Signature

_____

Printed Name & Title

_____

Company

Contractor Certification *(Required)*

Introduction: Texas Education Code Chapter 22 requires entities that contract with school districts to obtain criminal history records on covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors must certify to the district that they have complied and must obtain similar certifications from their subcontractors.

Definitions:
Covered individuals: Individual who have or will have continuing duties related to the service to be performed and have or will have direct contact with students. The District will be the final arbiter of what constitutes direct contact with students.

Disqualifying criminal history: (1) a conviction or other criminal history information designated by the District; (2) a felony or misdemeanor offense that would prevent a person from obtaining certification as an educator under Texas Education Code § 21.060, including 19 Tex. Admin. Code §249.16; or (3) one of the following offenses, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) an equivalent offense under federal law or the laws of another state.

On behalf of _____ ("Contractor"), I certify that [check one]:

[ ] None of Contractor's employees are *covered individuals*, as defined above. If this box is checked, I further certify that Contractor has taken precautions or imposed conditions to ensure that Contractor's employees will not become *covered individuals*. Contractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

[ ] Some or all of Contractor's employees are *covered individuals*. If this box is checked, I further certify that:

1. Contractor has obtained all required criminal history record information regarding its covered individuals. None of the covered individuals has a disqualifying criminal history.

2. If Contractor receives information that a covered individual subsequently has a reported criminal history, Contractor will immediately remove the covered individual from contract duties and notify the District in writing within three business days.

3. Upon request, Contractor will provide the District with the name and any other requested information of covered individuals so that the District may obtain criminal history record information on the covered individuals.

4. If the District objects to the assignment of a covered individual on the basis of the covered individual's criminal history record information, Contractor agrees to discontinue using the covered individual to provide services at the District.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

_____ _____
Signature Date

Felony Conviction Notification *(Required)*

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony".

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The District must compensate the person or business entity for services performed before the termination of the contract".

This Notice is Not Required of a Publicly-Held Corporation.

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

Vendor's Name:

Authorized Company Official's Name (Printed):

A. My firm is a publicly held corporation; therefore, this reporting requirement is not applicable.

Signature of Company Official:

B. My firm is not owned or operated by anyone who has been convicted of a felony.

Signature of Company Official:

C. My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:

Name of Felon(s): _____

Details of Conviction(s): _____

_____

Signature of Company Official:_____

Vendor Debarment Statement *(Required)*

I have read the conditions and specifications provided in the bid document attached.

I affirm, to the best of my knowledge, the company I represent has not been debarred or suspended from conducting business with school districts in the State of Texas. This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulation may be obtained by contacting the Department of Agriculture Agency with which this transaction originated.

_____

NAME OF COMPANY (Please Type)

_____

MAILING ADDRESS CITY STATE ZIP

_____

PREPARED BY (Please Type)

_____ _____

SIGNATURE TITLE

_____ _____

TELEPHONE NUMBER FAX NUMBER DATE

Check here if you have an address or telephone number change: Yes____ No____

Conflict of Interest Questionnaire *(Required)* COMPLETE AND SIGN EVEN IF NO CONFLICT EXISTS

CONFLICT OF INTEREST QUESTIONNAIRE FORM CIQ

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

OFFICE USE ONLY

Date Received

This questionnaire is being filed in accordance with Chapter 176, Local Government Code by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the person meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006, Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.**

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

Name of Officer

This section (item 3 including subparts A, B, C & D) must be completed for each officer with whom the vendor has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor of the questionnaire receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer named in this section AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership of one percent or more?

☐ Yes ☐ No

D. Describe each employment or business relationship with the local government officer named in this section.

Signature of vendor doing business with the governmental entity

Date

RETURN THIS DOCUMENT IN FRONT OF ORIGIONAL SUBMISSION PACKAGE

Certification regarding Lobbying *(Required)*

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of a Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying", in accordance with its instruction.

3) The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants and contracts under grants, loans, and cooperative agreements) and that all sub recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, US Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____	_____
Company	Authorized Representative (Print)
_____	_____
Signature	Date

Confidential Copyrighted Information *(Required)*

General Provisions Part III Paragraph 13

FBISD is a governmental body subject to the Texas Public Information Act. Solicitation Responses submitted to FBISD as a result of this Solicitation may be subject to release as public information after contracts are executed or the procurement is terminated. If a Vendor believes that its Solicitation Response, or parts of its Solicitation Response, may be exempted from disclosure under Texas law, the Vendor must specify page-by-page and line-by-line the parts of the Solicitation Response which it believes are exempt. In addition, the Vendor must specify which exception(s) to the Texas Public Information Act are applicable and provide detailed reasons to substantiate the exception(s). Vague or general claims to confidentiality will not be accepted. FBISD assumes no obligation or responsibility relating to the disclosure or nondisclosure of information submitted by Vendor.

By signing below, the Bidder agrees, if a bid is, or parts of bid is confidential, the bidder has specified by stamping in bold letters the term **"CONFIDENTIAL"** on all or the confidential part of the bid. The bid may be considered public information even though all or parts are marked confidential. Furthermore, Bidder agrees a copyrighted bid is unacceptable and will be disqualified as unresponsive.

_____	_____
Company	Authorized Representative (Print)
_____	_____
Signature	Date

Owner(s) Name of Business *(Required)*

Bidder certifies the owner(s) name of the business submitting bid is/are: (Please print name(s) below. If not applicable, please indicate N/A.)

Name	Title
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Delinquent Taxpayers *(Required)*

In accordance with law, the District shall not enter into a contract or other transaction with a person indebted to the District, nor shall the District award a contract to or enter into a transaction with an apparent low bidder or successful proposer indebted to the District.

[ ] I am not a delinquent taxpayer to Ft Bend ISD

[ ] I am a delinquent taxpayer to Ft Bend ISD *(your bid may be disqualified if your debt is not cleared prior to award.)*

_____

Signature

_____

Printed Name & Title

_____

Company

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 **Name of business entity filing form, and the city, state and country of the business entity's place of business.**

2 **Name of governmental entity or state agency that is a party to the contract for which the form is being filed.**

3 **Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the goods or services to be provided under the contract.**

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 **Check only if there is NO Interested Party.** ☐

6 **AFFIDAVIT**

I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

_____
Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said _____, this the _____ day of _____, 20 _____, to certify which, witness my hand and seal of office.

_____ _____ _____
Signature of officer administering oath | Printed name of officer administering oath | Title of officer administering oath

ADD ADDITIONAL PAGES AS NECESSARY

Form provided by Texas Ethics Commission www.ethics.state.tx.us Adopted 10/5/2015

FBISD CERTIFICATE OF INTERESTED PARTIES – FORM 1295

Certificate of Interested Parties (Form 1295 – must be filled out electronically with the Texas Ethics Commission's online filing application, printed out, signed, notarized, and attached to vendor's response to this solicitation.)

Fort Bend ISD ("FBISD") is required to comply with House Bill 1295, which amended the Texas Government Code by adding Section 2252.908, Disclosure of Interested Parties. Section 2252.908 prohibits FBISD from entering into a contract resulting from this RFP with a business entity unless the business entity submits a Disclosure of Interested Parties (Form 1295) to FBISD at the time business entity submits the signed contract. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission.

"Interested Party" means a person:

a) who has a controlling interest in a business entity with whom FBISD contracts; or
b) who actively participates in facilitating the contract or negotiating the terms of the contract, including a broker, intermediary, adviser, or attorney for the business entity.

"Business Entity" means an entity recognized by law through which business is conducted, including a sole proprietorship, partnership, or corporation.

"Controlling Interest" means (1) an ownership interest or participating interest in a business entity by virtue of units, percentage, shares, stock, or otherwise that exceeds 10 percent; (2) membership on the board of directors or other governing body of a business entity of which the board or other governing body is composed of not more than 10 members; or (3) service as an officer of a business entity that has four or fewer officers, or service as one of the four officers most highly compensated by a business entity that has more than four officers.

As a "business entity," all vendors must electronically complete, print, sign, notarize, and submit Form 1295 with their proposals even if no interested parties exist.

Proposers must file Form 1295 electronically with the Texas Ethics Commission using the online filing application, which can be found at https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm. Proposers must use the filing application on the Texas Ethics Commission's website to enter the required information on Form 1295. Proposers must print a copy of the completed form, which will include a certification of filing containing a unique certification number. The Form 1295 must be signed by an authorized agent of the business entity, and the form must be notarized.

The completed Form 1295 with the certification of filing must be filed with FBISD by attaching the completed form to the vendor's solicitation response.

FBISD must acknowledge the receipt of the filed Form 1295 by notifying the Texas Ethics Commission of the receipt of the filed Form 1295 no later than the 30th day after the date the contract binds all parties to the contract. After FBISD acknowledges the Form 1295, the Texas Ethics Commission will post the completed Form 1295 to its website with seven business days after receiving notice from FBISD.

Forms Certification *(Required)*

I, the undersigned authorized agent for the company named below, certify that the information concerning notification of felony convictions, Owner(s) Name of Business and Delinquent Taxpayers has been reviewed by me and the information furnished is true to the best of my knowledge. I further certify that I agree to comply with Section 22.0834. Criminal History Record Information Review of Certain Contract Employees, Texas Education Code if awarded a contract through this solicitation, the 31 U.S.C. 6101, note, E.O. 12549, E.O. 12689, 48 CFR 9.404 in relation to the Lists of Parties Excluded from Federal Procurement or Non Procurement Program, and Copyright/Confidential Information.

COMPANY NAME:_____

AUTHORIZED AGENT'S NAME (PRINTED):_____

SIGNATURE OF COMPANY OFFICIAL:_____

RETURN THIS DOCUMENT IN FRONT OF ORIGIONAL SUBMISSION PACKAGE

Provision Required in Contract (Govt. Code 2270.002) *(Required)*

RELATIONSHIPS WITH FOREIGN ENTITIES

During the 85th Legislative Session (2017), the State of Texas enacted two additional requirements affecting all government contracts for goods and services.

All government contracts for goods and services signed after September 1, 2017 must include required provisions from HB 89 (Certification Regarding Israel), and language to implement SB 252 (Verification Regarding Terrorist Organizations).

Therefore, in compliance with HB 89 and SB 252 of the 85th Texas Legislative Session, Contractor agrees that:

> In accordance with Texas Government Code Chapter 2252, Subchapter F, Contractor certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, the Government of Iran, the Government of Sudan, or a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State.
>
> Contractor further certifies and verifies that, pursuant to Texas Government Code Chapter 2270, neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and Contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of Agreement with Fort Bend ISD.

Name of Vendor ("Contractor")

Mailing Address | City | State | Zip

Prepared by | Title

RETURN THIS DOCUMENT IN FRONT OF ORIGIONAL SUBMISSION PACKAGE

A□□□□□□A□□□□□ □□□□□ □□□*(Required)*

I acknowledge the receipt of Addenda #___through #____, and my submittal reflects the contents of those addenda.

Name:_____

Signature:_____

Date:_____

BONDING CAPACITY CERTIFICATION LETTER

OWNER
Fort Bend Independent School District
555 Julie Rivers Drive
Sugar Land, TX 77478
281-634-1803

CONTRACTOR
Firm Name .....
Address .....
City, State, Zip Code .....
Phone .....

This letter serves as a certified statement that the Surety Company's authorized bonding capacity for the referenced Contractor will not be exceeded by the inclusion of Contractor's submitted proposal for FBISD's CSP _____, Title of CSP _____.
The present limits on bonding for the referenced Contractor are as follows:

$ ..... each occurrence.
$ ..... Aggregate

Percentage of bonding capacity expended with inclusion of FBISD's CSP _____, Title of CSP ……..%
Amount of ALL projects that the Contractor is currently preparing bid/proposals and/or have not yet been awarded: $.....
(Amount indicated above must be representative of all projects inclusive of delivery methods such as the following but not limited to: Competitive Bids, Competitive Sealed Proposals, Design-Build, Construction Manager at Risk, Job Order Contracting etc.,)

Issuance and approval of any bond shall be predicated on the most current financial and job information available to the underwriter on the date that the bond is issued. The Surety Company hereby certifies that they are duly authorized by certificate of authority issued by the State of Texas Division of Insurance and that they are rated as follows:

A.M. Best Rating: .....

Financial Size Category .....

Notes: This is the only acceptable format for the Surety's Bonding Capacity Certification Letter.

This statement must be <u>notarized</u> (on an original document with an embossed stamp).
Power of Attorney form must be attached.

<u>SURETY COMPANY</u>

Surety Company Name .....
Address .....
City, State, Zip Code .....

Authorized Signature: .....
Date: ...../...../.....

ACKNOWLEDGMENT

State of _____

County of _____

Subscribed and sworn to before me this
_____***day of*** _____ ***2024***

My Commission Expires _____

(Notary Seal)

FBISD
INSPIRE • EQUIP • IMAGINE
BUSINESS & FINANCE

CONFLICT OF INTEREST QUESTIONNAIRE

All vendors doing business with Fort Bend Independent School (FBISD) must complete and submit a Conflict of Interest Questionnaire (CIQ).

FBISD is required to comply with Texas Local Government Code Chapter 176, Disclosure of Certain Relationships with Local Government Officers. Any company that does business with FBISD must complete and submit a Conflict of Interest Questionnaire (CIQ) whether or not a conflict of interest exists.

Statements must be filed within seven (7) business days after the officer becomes aware a conflict of interest exists.

FBISD Board of Trustees include:

Ms. Kristin K. Tassin, President

Mr. Adam Schoof

Dr. Shirley Rose Gilliam

Ms. Angie Hanan

Ms. Sonya Jones

Mr. Rick Garcia, Vice President

Mr. David Hamilton, Secretary

Dr. Marc Smith, Superintendent

Current Local Government Officers includes:

Kathleen Brown, Deputy Superintendent

Dr. Jaretha Jordan, Deputy Superintendent

Beth Martinez, Deputy Superintendent

Coby Wilbanks, General Counsel

Glenda Johnson, Chief Human Resources Officer

David Rider, Chief of Police

Kwabena Mensah, Chief of Staff

Damian Viltz, Chief Operations Officer

Rhonda Mason , Asst Superintendent Elem

Dr. Stephen Warford, Asst Superintendent Sec

Antignolo Matthew, Exec Dir Child Nutrition

Pandit Payal, Exec Dir Collab Communities Daniel

Bankhead, Exec Dir D & Construction Nunez

Wendy, Exec Dir Elementary Schools Mason

Rhonda, Exec Dir Elementary Schools

Ford Ida, Exec Dir Elementary Schools

Dr. Adam Stephens, Chief Academic Officer

kimberly Smith, Chief Communications Officer

Bryan Guinn, Chief Financial Officer

Long Pham, Chief Information Officer Morgan

Aaron, Exec Dir Facilities

Schlacks Kelly, Exec Dir Finance

Amber Williams, Exec Dir HR

Jojo Jacob Exec Dir Info Systems

Christopher Nilsson, Exec Dir Info Tech Service

Dr. Andria Schur, Chief of Schools

Williams Stephanie, Exec Dir Org Development

Elizabeth Williams, Exec Dir Secondary Schools

Lyons-Lewis, Deidra Exec Dir Sec. Schools

Westbrook Pilar, Exec Dir Sel & Comp.Health

Lisa Langston Exec Dir Student Affairs

Hill Deena, Exec Dir Student Supp Svc

Hubbard Melissa, Exec Dir Teach & Learning

Richard Gay, Exec. Dir. Business Services

HOW TO COMPLETE THE CIQ FORM

NO CONFLICT EXIST

If no conflict of interest exists, you MUST:

1. Fill out Box 1
2. Type N/A on Box 3 of the CIQ form
3. Sign and date

CONFLICT EXIST

If a conflict of interest exists, you MUST:

1. Name of person doing business with the District. If the business is a corporation, partnership, etc., then each person who acts as an agent for the business in dealings with Fort Bend ISD must complete the form. Also, state company name. If no conflict of interest exists, you must fill out Box 1 and type N/A on Box 3 of the CIQ form, sign and date it.
2. Check the box if you are filing an update to a previously filed questionnaire. Updates are required by law by September 1 of each year in which the person submits a proposal or bid or begins contract discussions or negotiations with the District. Updates are also required by the 7th business day after an event that makes a statement in a previously filed questionnaire incomplete or inaccurate.
3. Name the District employee or school board member with whom you have a relationship, if there is no relationship in question, state “NONE”.
4. Answer questions A and B with “Yes” or “No”, as applicable.
5. Describe how you are affiliated or related to a FBISD employee or school board member.
6. Check Box if applicable
7. Signature Box: Date and Sign the form. A signature is required from the person completing the form even if “No” is entered in Box 3, A, B, C, or D.

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____

Signature of vendor doing business with the governmental entity Date

SECTION 00 01 01 – PROJECT TITLE PAGE

TITLE AND LOCATION OF THE WORK:

FBISD BP031 – Bush High School Renovations

NAME AND ADDRESS OF THE OWNER:

Fort Bend Independent School District
16431 Lexington Blvd.
Sugar Land, TX 77479

ARCHITECT AND CONSULTANTS:

STANTEC ARCHITECTURE
ARCHITECT
910 Louisiana Street, Suite #2600
Houston, Texas 77002
713-548-5700

DBR
MEP ENGINEER
9990 Richmond Avenue
South Building Suite 300
Houston, Texas 77042
713-914-0888

BAI, LLC
ACOUSTICAL CONSULTANT
4006 Speedway
Austin, Texas 78751
512-497-2222

S&G ENGINEERING CONSULTANTS
CIVIL ENGINEER
1796 Avenue D, Suite B
Katy, Texas 77493
832-437-7377

COMBS CONSULTING GROUP
LOW VOLTAGE CONSULTANT
1022 River Road #2
Boerne, Texas 78006
210-698-7887

MATRIX STRUCTURAL
STRUCTURAL ENGINEER
5177 Richmond Avenue, Suite 670
Houston, Texas 77056
713-333-0102

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
LIST OF DRAWINGS
CONTRACT DOCUMENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS
Section 00 31 13 PRELIMINARY SCHEDULES

1.1 PROJECT SCHEDULE

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but do not affect Contract Time requirements. **This Document and its attachments are not part of the Contract Documents.**

B. Available Project information includes the following:

1. EXHIBIT A (PROJECT LOCATION MAP).

2. EXHIBIT B (PRELIMINARY CONSTRUCTION TIMELINE).

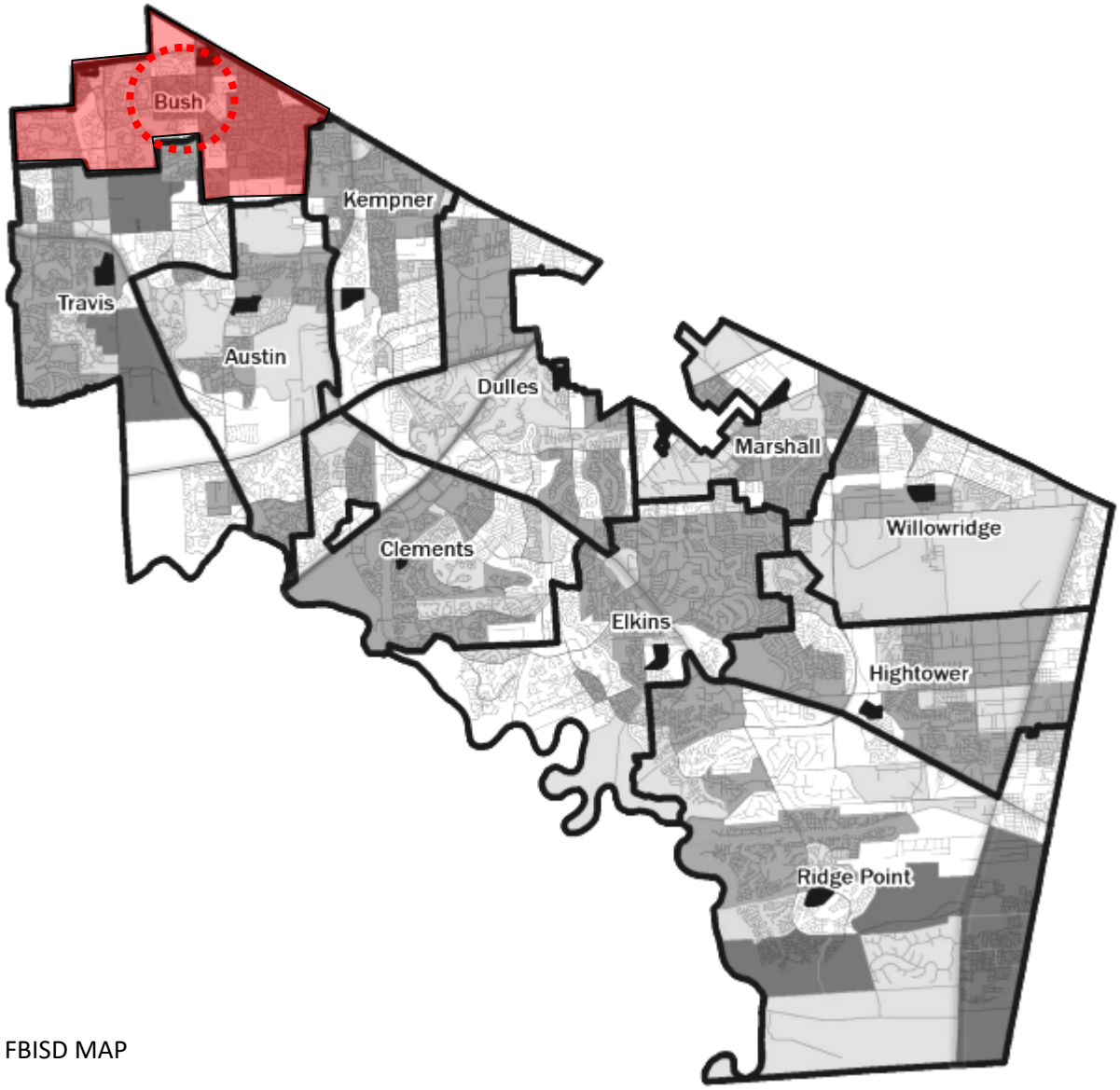
C. Project schedule including design and construction milestones and Owner's occupancy requirements is available by request. General Project information is located in section 01 10 00 “Summary of Work”.

D. Related Requirements:

1. Fort Bend ISD Preferred Sample Base Bid Form AD R2 & Fort Bend ISD Alternates Sample Alternate Bid Form R2 for Contract Time.
2. Section 01 10 00 "Summary of work " for construction requirements.

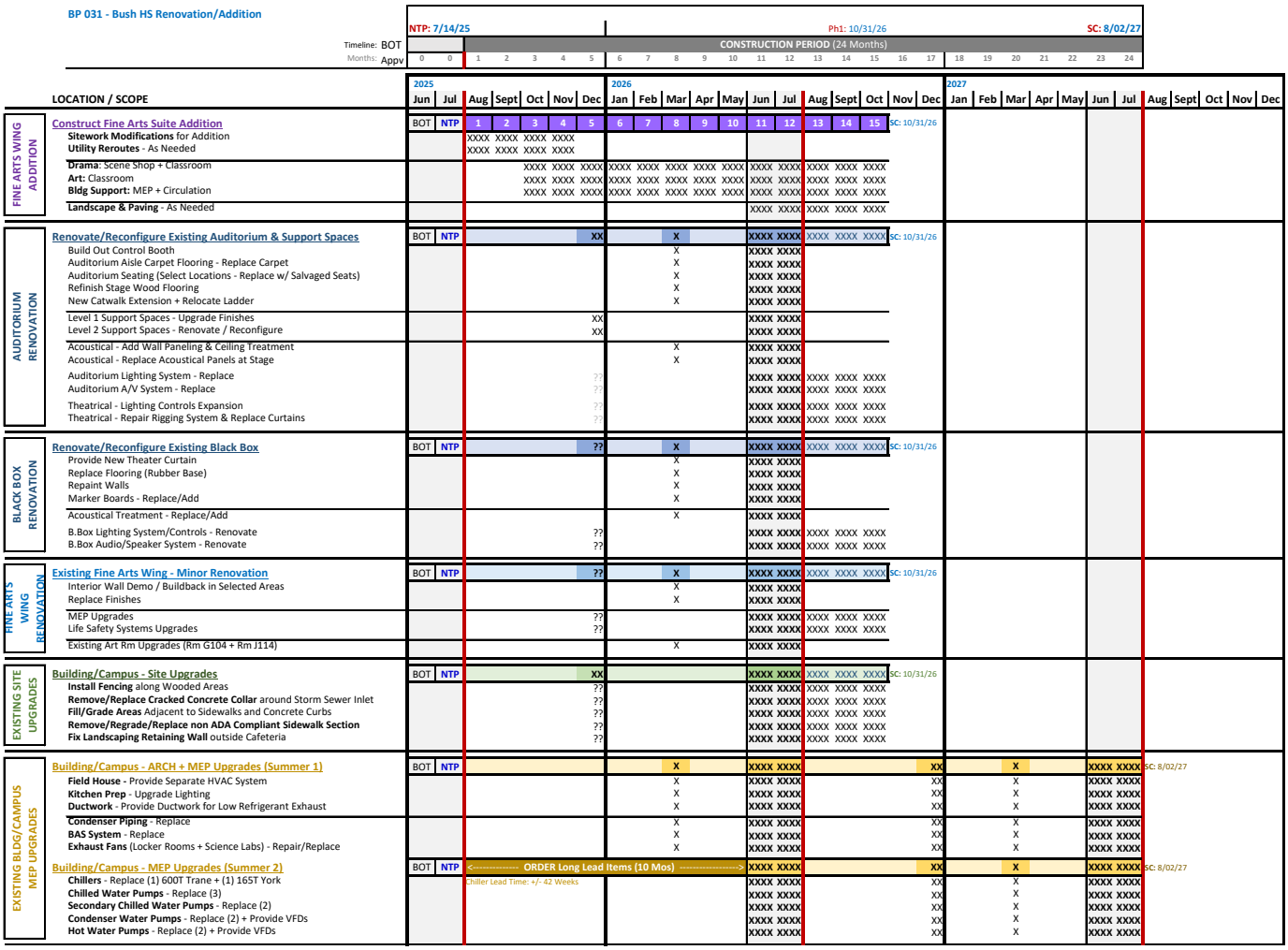
Procurement	103 days	Thu 2/20/25	Mon 7/14/25
Notify Newspaper of Advertisement	1 day	Thu 2/20/25	Thu 2/20/25
First Advertisement	1 day	Tue 2/25/25	Tue 2/25/25
Second Advertisement	1 day	Tue 3/4/25	Tue 3/4/25
Pre-Proposal Meeting	1 day	Thu 3/6/25	Thu 3/6/25
Pre-Proposal Walk	1 day	Thu 3/6/25	Thu 3/6/25
Last Day for Questions	1 day	Tue 3/18/25	Tue 3/18/25
Last Day for Response	1 day	Mon 3/24/25	Mon 3/24/25
Open Bids	1 day	Tue 4/1/25	Tue 4/1/25
Evaluate Bids	7 days	Tue 4/1/25	Wed 4/9/25
Negotiate w/ Highest Ranked Firm	10 days	Thu 4/10/25	Wed 4/23/25
BOT Agenda Draft to Exec. Director	1 day	Mon 4/21/25	Mon 4/21/25
BOT Agenda Due to COO	1 day	Thu 5/1/25	Thu 5/1/25
BOT Meeting/Approval	1 day	Mon 6/23/25	Mon 6/23/25
GC Contract	15 days	Tue 6/24/25	Mon 7/14/25
Material Testing Contract+ PO	2 wks	Tue 6/24/25	Mon 7/7/25
Testing & Balancing Contract+ PO	2 wks	Tue 6/24/25	Mon 7/7/25
Commissioning Contract+ PO	2 wks	Tue 6/24/25	Mon 7/7/25

Exhibit A – Preliminary Schedules | Project Location Map



FBISD MAP

Exhibit B – Preliminary Construction Timeline



END OF DOCUMENT

SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 GENERAL

1.1 SOIL INVESTIGATION DATA

A. Investigation and Report:

After soil and subsurface investigations were conducted at the Project site, the Owner has obtained geotechnical report **No. EE-2411101-G for Bush HIgh School** dated February 29, 2024E issued by Earth Engineering, Inc. Proposers are urged to read the report prior to making any proposals for related construction.

Soils investigation data is not a part of the Contract Documents.

These reports are made available to Proposers for information only, and Proposers are urged to examine soils investigation data and to make their own investigations of the site before submitting proposals.

B. Interpretation of Report:

Neither the Owner, Architect, or Consultants warrant the accuracy or the completeness of the report. In submitting any Proposal, the Proposer acknowledges and represents that they have reviewed the report and have made their own independent assessment of the conditions of the site and the requirement of the work, and that they are solely responsible for decisions pertaining to implementation of the geotechnical recommendations.

GEOTECHNICAL EXPLORATION REPORT FOR THE PROPOSED FINE ARTS BUILDING ADDITION AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464, RICHMOND, TX 77407

Reported to

MR. MR. JOSE GARCIA, CPC
FBISD DESIGN AND CONSTRUCTION DEPARTMENT

Prepared By

EARTH engineering, inc.

down to earth solutions for your complex projects

EARTH ENGINEERING, INC.
HOUSTON, TEXAS

EARTH ENGINEERING, INC. 28th ANNIVERSARY 1996 – 2024

Project No: EE-2411101-G

Issue date: February 29, 2024

EARTH ENGINEERING, INC.

Geotechnical, Materials Testing & Environmental Consultants

4877 Langfield Road • Houston, TX 77040 • T: (713) 681-5311 • F: (713) 681-5411 • www.eartheng.com

down to earth solutions for your complex projects

February 29, 2024

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Proposal No.: P-EE 2411101-G
Sent via email: cn_Jose.Garcia@fortbendisd.com

SUBJECT: GEOTECHNICAL EXPLORATION REPORT FOR THE Proposed Fine Arts Building Addition AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464, RICHMOND, TX 77407

Dear Mr. Garcia:

Earth Engineering, Inc. is pleased to submit the results of the geotechnical exploration study for the above-referenced project. This report briefly presents the findings of the study along with our conclusions and recommendations for the design of the foundation for the above project.

We appreciate the opportunity to serve you and look forward to working with you in other future projects. We also look forward to providing the materials testing inspection phase on this project.

Should you have any questions regarding this report or any questions pertaining to soils engineering or materials testing, please do not hesitate to call me at (713) 681-5311 or email me at moes@eartheng.com at any time.

Yours very truly,
EARTH ENGINEERING, INC.

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1.0 INTRODUCTION

Planning is underway for the construction of the proposed 11,450 sq. ft. single story stud wall with masonry veneer fine art building addition for George Bush High School located at 6707 FM 1464, Richmond, TX 77407. The new classroom addition will be constructed attached south to the existing building. It is understood that the final design grades are likely to tie into the existing structure. Based on this site conditions, it appears about 2-4 ft of fill will be required in the building addition areas to match the existing building grade.

At the time of drilling, the drilling site was covered with grass. The approximate site location is presented on Plate 1.

JM Drilling. was contracted to drill the borings. Four (4) borings were drilled at a depth of 20 feet at the building addition area utilizing a portable drilling rig. Approximate boring locations are presented in Plate 2.

2.0 SCOPE OF WORK

The scope of our services is presented below:

- Drilling, sampling four (4) borings to a depth of 20-feet in the proposed building addition areas.
- Obtaining continuous soil samples to a depth of 12 feet, and then at five (5) foot intervals thereafter to the borings' termination depths.
- Earth Engineering will perform granular soil sampling utilizing the Standard Penetration Test (split spoon sampler) by driving. Blow counts will be recorded as produced by a 140-pound weight falling 30 inches (ASTM D-1586). Cohesive soils will be sampled using a thin-walled sampler (Shelby Tube) hydraulically pushed into the soil (ASTM D-1587).
- Performing laboratory tests on selected representative soil samples to develop the engineering properties of the soil. These tests may include: pocket penetrometers, unconfined compression, present moisture content, percent passing 200 sieves, dry densities, Atterberg Limits, and swell tests, as deemed appropriate.
- Utilizing the results of observations both in the field and in limited laboratory tests, Earth Engineering will author a report that will include the following subjects:
  - ❖ soil stratigraphy: soil encountered up to 20 feet
  - ❖ groundwater conditions and groundwater control during construction

- ❖ boring log information will include all laboratory test results and field observations
- ❖ recommend suitable foundation design options for the building addition
- ❖ recommend slab on-grade design criteria, including the need for sub-grade replacement with fill or lime stabilization of the sub-grade
- ❖ calculate the soil heave using the potential vertical rise (PVR) method
- ❖ recommend whether structural slabs are required in lieu of slab on-grade
- ❖ present plates necessary to calculate uplift capacity and lateral capacity of drilled and underreamed piers, if necessary
- ❖ recommend construction considerations, as deemed necessary
- ❖ recommend back-fill material specifications

- Incorporating all of the above into a geotechnical engineering report which is performed under the direction of, and signed by, a professional engineer registered in the State of Texas.

3.0 SUBSURFACE EXPLORATION

3.1 Sampling Techniques

The subsurface conditions were explored by a total of four (4) borings. The boredom was drilled by a portable drilling rig. A portable rig was used to collect samples to minimize damage to the landscape areas. The boring locations are shown on Plate 2.

Samples in cohesive and semi-cohesive soils (clays, sandy clays, and silty clays) were obtained using a three-inch diameter Shelby Tube sampler advanced hydraulically by one stroke in accordance with the procedures outlined in ASTM D-1587. Samples were extruded in the field, visually classified, and a strength estimate was obtained with a pocket penetrometer. Penetrometer readings are tabulated on the logs of borings. Representative portions of the samples were wrapped with aluminum foil and sealed for transport to the laboratory for further testing.

3.2 Sample Disposal

In general, soil samples (both tested and untested) will be discarded 30 days after the submittal of the final report, unless otherwise notified by the client.

4.0 LABORATORY TESTING

The laboratory-testing program was designed and directed towards evaluating the physical and engineering properties of the subsoils. Physical properties include Atterberg limits (liquid limits and plastic limits), moisture content for clays, and percent passing #200 sieve for sands. Engineering properties include shear strength of the soil, compressibility of the soils, and the swell characteristics of the soils. It should be noted that the testing program varies for each project and depends solely on the project budget and emphasis. Typically, Earth Engineering, Inc. specifies the anticipated testing program in each proposal. The tests undertaken in this program included the following:

Laboratory Tests	Applicable Test Standards	Number of Tests
Liquid Limit, Plastic Limit, and Plasticity Index of Soil	ASTM D-4318 Method B	10
Moisture Content	ASTM D-2216	11
Finer than 75-µm (No. 200) Sieve	ASTM D 1140	3

Laboratory test results are presented in the Logs of Borings, Plates 3 through 6. A Key to Log Terms and Symbols is presented in Plate 7. It should be noted that the soils were classified following the Unified Soil Classification System (ASTM D-2487).

5.0 SUBSURFACE STRATIGRAPHY

5.1 Site Location and Conditions

The project site is located at 6707 FM 1464, Richmond, TX 77407. Please refer to Plate 1 for a map designating the location of the site. At the time of drilling, the borings' locations were covered with grass and gravel.

Based on our visual observations during drilling operations, it appears that the site and the surrounding area exhibit topographic variations of less than four (4) feet. Surveying maps with existing and proposed elevations including the finished floor elevations was not available at this time.

5.2 Local Geology

Based on a review of literature and public maps in our library, as well as our experience, the project site lies within the Coastal Prairies Province of the Gulf Coastal Plains Physiographic Region of Texas and is underlain by soils common to the Beaumont Formation.

The Beaumont Formation is late Pleistocene in age. The Beaumont Formation outcrop covers a large part of the lower coastal plain except where cut by modern river valleys or covered by Holocene wind-blown sand in south Texas. The Beaumont Formation is composed of clay-rich sediments transected by sandy fluvial and deltaic-distributary channels. The Beaumont Formation also includes isolated segments of coast-parallel, sandy beach ridges known as the Ingleside barrier/strandplain system. The Beaumont depositional episode records a continuation of patterns that developed during deposition of the Lissie Formation including high-frequency, glacio-eustatic, sea-level fluctuations, and dominant fluvial sediment input. At sea-level highstand, the position of the Beaumont Formation shoreline approximately coincided with that of the modern shoreline.

The Beaumont Formation ranges in thickness from a thin veneer in updip areas to about 500 ft near the modern coast, and thickens to the northeast. The Beaumont Formation dips coastward from 1 to 10 ft per mile. Individual sands range from 20 to 50 ft thick, stacking locally to reach 150 ft in thickness. Interbedded muddy intervals are generally of similar thickness to the sands. Thicknesses of individual sands increase updip, whereas thicknesses of individual shales increase downdip..

According to the United States Department of Agriculture (USDA) Web Soil Survey, the surficial soils at the site are described as being Lake Charles clay. The plasticity index varies from low 26 to a maximum of 44.

5.2 Subsurface Conditions

The subsurface conditions at the project site were evaluated based on four (4) borings. Soil stratigraphy details are presented on the Log of Borings, Plates 3 through 6. The soil strata listed below are general and highlight major subsurface soils. The borings logs include a summary of soil properties at certain depths.

The stratifications shown on each boring log represent the conditions and approximate boundaries between strata at that actual boring location only. The actual transitions between strata may be gradual. Variations will occur and should be expected at locations away from each boring location.

Based on field logs and laboratory test results, the subsoil stratigraphy is approximately as follows:

Stratum No.	Range* of Depth, ft.	Soil Description and Classification (Based on Unified Soil Classification System)
I	0-2 at **B-1** 0-4 at **B-2** and **B-4** 0-8 at **B-3**	**FILL: SANDY LEAN CLAY (CL)/FAT CLAY (CH)**, soft to firm, gray, brown, dry with roots fibers, and sand seams and layer
II	2-20 at **B-1**	**SANDY LEAN CLAY (CL),** firm to very stiff, gray, reddish brown, light brown, dry with calcareous nodules
III	4-20 at **B-2** and **B-4**	**FAT CLAY (CH),** firm to very stiff to stiff, tan, gray, red, brown, dry with calcareous nodules and ferrous nodules
VI	8-20 at **B-3** to **B-3**	**SANDY SILTY CLAY (CL-ML)/FAT CLAY (CH),** firm to very stiff, dry to wet, reddish brown, gray

*These stratum depths are based on measurements referenced from the ground surface at the time of our drilling activities on February 4, 2022. Please note that the depths of the stratum changes vary; please refer to the borings log presented on Plates 3 through 6 for stratum changes at specific locations.

Stratum I consists of fill soils. These soils are low to high plastic with an average plasticity index (PI) of 8 to 56. Please note that structures constructed at this site will be susceptible to perched water conditions due to the presence of these soils. Please refer to Section 5.4 Perched Water Conditions for details

Stratum II consists of firm to very stiff sandy lean clays, these soils are low to medium in plasticity with the plasticity indices (PI) ranging from 26 to 30. Please note that soils with plastic index above 25 may experience significant shrink or swell movement due to changes in the moisture content.

Stratum III consists of a firm to very stiff to stiff fat clays. These soils are high in plasticity with the plasticity indices (PI) ranging from 32 to 42. Please note that soils with plastic index above 25 may experience significant shrink or swell movement due to changes in the moisture content.

Stratum IV consists of sandy silty clays. These soils are low PI with an average plasticity index (PI) of 8. Please note that structures constructed at this site will be susceptible to perched water conditions due to the presence of these soils. Please refer to Section 5.4 Perched Water Conditions for details.

5.3 Groundwater Conditions

The borings were drilled using a flight auger (dry method) to better assess the groundwater conditions. Groundwater **was** encountered below the existing grade during drilling operations. Groundwater conditions are presented in the table below.

Boring Locations	Initial Groundwater	Groundwater After 15 Minutes
B-1, B-2 and B-4	17 feet	15 feet
B-3	7 feet	5 feet

Groundwater fluctuations in an area can be caused by several factors including seasonal rainfall quantity in the area, the presence of wells near the site, the relative location (upstream or downstream), and proximity of the site to any bayous or streams.

Accurate groundwater measurements can be measured only using piezometers or monitor wells. Piezometer installation was beyond the scope of this project. *The groundwater level should be verified before drilled piers excavation and the commencement of utility construction.*

5.4 Perched Water Conditions

Soft fill soils were encountered in the upper **two (2) feet to eight (8) feet** at borings during drilling operations. Less permeable sandy lean clays underlie the soft fill clays. During inclement (rainy) weather, rainwater permeates through these surficial clays and ponds on top of the lean clays and creates a perched (trapped) groundwater condition.

Perched water tends to soften the lean clays underlying the surficial fill soils, and severely undermines the slab integrity and can result in premature slab failure and/or pavement failure.

One of the options listed below should be utilized to mitigate the perched groundwater effects in the slab and pavement areas during inclement rainy weather:

- Excavate the upper two (2) feet of silty sandy clay and replace with structural fill. Place in eight-inch lifts and compact to 95% as specified by ASTM D-698. The actual depth should be determined in the field (best option).

- Chemically stabilize the existing fill soils clay with 5% lime.

5.5 Existing Fill

Existing fill was encountered at the surface and extending to depth of two (2) feet to eight (8) feet below the existing grade during drilling operations. These fill soils consist of firm to very stiff sandy lean clays and/or fat clay soils.

No information is presently available as to the age, method of placement and compaction, origin and extent of these materials. Based on the field logs, the existing fill soils were properly compacted with plasticity indices values fall within the recommended ranges for select fill, hence no further action is needed.

If the soil encountered consists of deleterious materials or concrete debris or soft organic soils, it is highly recommended to remove these materials and replace them with select fill compacted to 95% of the maximum dry density.

6.0 ANALYSIS AND RECOMMENDATIONS

It is important to account for potential differential movements between the existing building and the proposed new addition. Proper methods should be implemented to accommodate any potential differential movement that may occur between the foundation systems of the existing building and the new addition. Additionally, precautionary measures should be taken during construction activities to prevent damage or adverse effects on the integrity of the existing foundation system. It is also recommended that the same foundation should be used for the addition to the existing building to minimize differential settlement.

6.1 General

To assure a satisfactory foundation performance, foundations should be designed to fulfill the following requirements:

- The imposed structural loads should not exceed the allowable bearing capacity,
- The potential total settlement and differential settlement are within tolerable limits of the structure, and
- The potential soil heave is within tolerable limits of the structure.

Foundation design recommendations are presented in the following paragraphs.

6.2 Foundation Types and Associated Risks

Construction of lightly loaded structures is challenging for engineers, architects, developers, and builders. It is our experience that economic considerations usually govern the choice of foundation systems and the associated risks. There are associated risks with all of the foundation systems. However, in general, risks decrease as the cost of the foundation system increases. A list of the most common foundation systems that are used in the Houston and Gulf Coast area for residential projects is shown below. *These foundation systems can be used to support the proposed structure. It should be noted that the first option is the least risky while the floating slab is riskier.*

(1) Drilled Piers with a Structural Slab: This type of foundation consists of drilled and under-reamed piers (bell-bottoms) with a structural (self-supporting) slab. A minimum crawl space of six (6) inches should be used beneath the slab and the grade beams. This foundation system is considered the least risky because the slab is isolated from the on-site soils. The use of structural fill is not necessary if a structural slab is selected.

(2) Drilled Piers with a Slab-on-Fill: This type of foundation consists of drilled and under-reamed piers (bell-bottoms) with a slab-on-fill floor system. In our experience, we have found that properly designed and constructed drilled piers incorporating a slab on-fill floor system function very well in the Houston area, provided certain techniques are implemented. These techniques include maintaining positive drainage (drainage away from the foundation) around the structure and controlling vegetation and tree growth near the structure. Both of these techniques need to be utilized throughout the life of the structure. The Owner, the Architect, the Structural Engineer, the Project Manager, and the Civil Engineer should note with full knowledge that the slab-on-fill floor system may experience differential movements during its life due to changing environmental conditions at the site, including but not limited to altered drainage patterns, sewer leakages, and the addition or removal of trees and shrubs.

6.3 Drilled and Under-reamed Piers

6.3.1 Allowable Bearing Capacity

Based on the subsurface conditions, **drilled and under-reamed piers** are the best foundation systems to be utilized for support of the proposed building. Groundwater **was encountered** at depths ranging from **5 feet to 15 feet** below the existing grade during drilling operations on February 4th, 2024.

Due to the presence of shallow water and soft sandy silty clay with sand seams and layer encountered at the site, drilled straight shaft may need to be utilized as foundation alternative.

Refer to Section 5.3 for details on groundwater conditions. Foundation recommendations are presented as follows:

Depth Below Existing Grade (feet)	Allowable Bearing Capacity (psf) Dead Plus Sustained Live Load Factor of Safety = 3	Allowable Bearing Capacity (psf) Maximum Net Load Factor of Safety = 2
13[(1)(3)]	2,000	3,500

Notes:

1. **Groundwater was encountered during drilling operation on 2/4/2024. In general, the groundwater table may fluctuate with seasonal rainfall and proximity of the job site to a bayou or a stream or a lake.**
2. **We highly recommend installing at least five (5) test piers before the installation of production piers to verify the soil stratigraphy and current groundwater table.**
3. **Soft soils were encountered at various depth at all of the borings drilled on site. Therefore, bearing capacity was lowered to reduce the differential settlement.**
4. The drilled piers should be founded at least two (2) bell diameters measured center to center.
5. Final grade elevation is not available at this time.
6. It is recommended to limit the bell to shaft ratio to 3:1. In the event that bell caving occurs during construction, a bell to shaft ratio of 2:1 should be constructed.
7. **Due to the presence of soft sandy silty clay with sand seams and layer at the site, drilled straight shaft may need to be utilized as foundation alternative.**

Soil stratigraphy and groundwater level may vary within the proposed construction site. Therefore, we recommend installing at least four (4) corner piers and one (1) center pier before foundation construction begins to verify the groundwater level and soil stratigraphy at the site. The depths of the other piers may be adjusted accordingly.

We recommend that each footing be sufficiently reinforced throughout the full length of the shaft to prevent any cracks, which may result from the tensile stresses induced by the clay soils. Since the uplift stresses are applied at the shaft, it is recommended to limit the bell to shaft ratio to 3:1, thus reducing the area upon which the uplift stresses act. However, if bell caving occurs during construction, a bell to shaft ratio of 2:1 should be constructed.

Some field adjustments may be required to keep the bottom of the piers above any caving soils and/or groundwater encountered during pier installation. Adjustments in the depths of the piers should be observed in the field by ***EARTH ENGINEERING*** *personnel. Submersible pumps, bailing tools, and/or immediate placement of concrete may be sufficient to control light seepage. Temporary casing may also be necessary to prevent sloughing of soils during pier drilling operations and to control water seepage as encountered.*

6.3.2 Uplift Pressures from Expansive Soils

As mentioned earlier, drilled piers should be designed to resist both axial and uplift loads. Uplift pressures are applied at the perimeter of the pier/shaft. We recommend designing the drilled piers to resist uplift adhesion stresses of 900 psf along the upper eight (8) feet of the shaft length. We recommend that each pier/shaft be sufficiently reinforced throughout the full length of the shaft to prevent any cracks that may result from the tensile stresses induced by the expansive clays.

Uplift forces due to expansive soils can be estimated using the following equation:

$$Q_{uf} = 3.142 * Z_a * B_s * f_a \quad \text{.....(1)}$$

Where:

Q_{uf}	=	Uplift force due to swelling pressure, kips
Z_a	=	Depth of Active Zone, feet = 8 feet
Z_a	=	Depth of Active Zone, feet = 3 feet for paved areas and areas covered with slab
B_s	=	Shaft diameter, feet
f_a	=	Uplift adhesion stress, ksf = 0.9 ksf

6.3.3 Uplift Capacity of Drilled and Under-reamed Piers

The uplift capacity of a single drilled and under-reamed pier in clay can be estimated using the following equation:

$$Q_{u\,max} = [N_u * C + \gamma * D_b] * A_u + W_{DL}$$

Where:

Q_u	=	Maximum uplift capacity in kips
C	=	Average Shear Strength, kips per square foot (ksf) = 1.0 ksf (Safety Factor =2.0)
N_u	=	Bearing Capacity Factor for Uplift = 3.5 * (D_b / B_b)
D_b	=	L-Z_a, feet
L	=	Length of Pier, feet
Z_a	=	Depth of Active Zone, feet = 8 feet; Z_a = 3 feet for paved areas and in slab areas.
B_b	=	Pier bell diameter, feet
B_s	=	Shaft Diameter, feet
γ	=	Design unit weight of soils = 120 pcf
A_u	=	0.785 * (B_b^2-B_s^2), square feet
W_{DL}	=	Dead Load on Column, kips

6.4 Potential Floor Slabs Associated with Drilled Piers

6.4.1 Structural Slab

Based on the existing soil conditions, a structural floor system with a 6-inch void/crawl space placed beneath the slab and the grade beams is the most suitable for the structure.
Foundation recommendations and associated risks were discussed in previous paragraphs. *The structural slab usually entails the least risk because it is isolated from the on-site soils.* If a structural (suspended) floor system is selected, the structural fill will not be required to reduce the Potential Vertical Rise (PVR).

6.4.2 Slab on-Fill

Based on the boring log B-3, soft to firm sandy silty clay fill soils were encountered at the surface and extending at a depth of 8 feet. Based on site reconnaissance and review of Google Earth, a underground drainage is existing at the boring -3 location. It is possible the utility was loosely backfill with sandy silty clay soils. If encountered, soft soils should be removed from the slab areas and replaced with compacted select fill soils.

Although the use of a structural slab is strongly recommended due to the isolation of the slab from the existing soils at the site, a foundation system incorporating drilled piers or straight shafts with a slab on-fill can be used for this project. Foundation recommendations and associated risks were discussed in previous paragraphs. ***The structural slab usually entails the least risk because it is isolated from the on-site soils***. However, we understand the cost of such a system is usually cost prohibitive if the area of the slab is large.
Slabs supported on compacted fill have been successfully used in the Houston and Gulf Coast area. This option is usually economically feasible and can be effective if used with positive drainage and vegetation and tree control. Positive drainage entails directing the rainwater away from the structure and not allowing the water to pond or collect near the structure throughout its life.

The potential of a soil to heave is critical in determining the amount of fill necessary for a slab on-fill system. The potential soil heave was estimated using the Potential Vertical Rise (PVR) method. The PVR method was a result of extensive research by the Texas Department of Highways and Public Transportation in 1971 and 1972. Based on this method (TDHPT Method TEX-124-E), PVR was estimated with different fill thickness.

To quantify the risk involved due to expansive soils, Earth Engineering developed a unique in-house program called "**PVR CALC**". The program is written in Visual Basic code for Windows and uses the TEX-124-E method to compute the Potential Vertical Rise (PVR). The table below shows the input data for the PVR analysis.

Depth, feet	LL, %	PL, %	PI, %	Existing W,%	Moisture Condition
0-2	51	19	32	16	Dry
2-4	53	19	34	23	Dry
4-6	54	19	35	17	Dry
6-8	63	21	42	25	Dry
8-10	63	21	42	25	Dry

LL: Liquid Limit, PL: Plastic Limit, PI: Plastic Index, W: Moisture Content

The generally accepted practice in Houston and the surrounding area is to limit the PVR to one inch or less. The amount of fill required to limit the PVR to one inch can lower the risk of heave to an acceptable level. The one (1) inch tolerable (design) heave is a serviceability index only.

Foundation movements resulting from potential vertical rise (PVR) of one (1) inch or less do not account for the movement criteria required by the owner or occupants of the facility. The operational performance criteria may often be more restrictive than the structural criteria of one (1) inch of PVR. If a more stringent criterion is required of less than one (1) inch of PVR; Earth Engineering should be contacted to revise the recommendations to fit the new movement criteria. In past projects, the author of this report has observed cracks in slabs that were caused by a heave of about one-fourth (1/4) inch. However, a combination of a sound structural design coupled with sound construction methods, proper drainage, and proper maintenance will reduce the possibility of heave.

Either the existing or dry condition can be used to estimate the amount of heave. Based on the existing and dry conditions, it is estimated that the PVR will be **2.43 and 3.99 inches, respectively**. Remedial action will need to be taken to reduce the PVR to an acceptable level as the estimated PVR for the in-situ soils is more than one (1) inch.

If drilled and under-reamed piers with slab on grade foundation system is selected, we highly recommend one of the following options. **(If these options are not feasible, use structural slab with at least 6-inch void boxes.)**

1. Excavate and remove at least six (6) feet of expansive soils, lime stabilize the subgrade soil from six (6) feet to seven (7) feet with 7% lime (70 lbs per square yard per 12 inches of depth) and backfill with select structural fill compacted in 8-inches lift to 95% of the maximum proctor density.

2. Excavate seven feet of the existing expansive soil, stockpile on site then mix with 7% lime (70 lbs per square yard per 12 inches of depth). Backfill the mixed soil in 8-inches compacted lifts to 95% of the maximum proctor density within a ± 3 percent of the optimum moisture content. The

plasticity indices (PI's) of the mixed soil should ranging between 12 and 20.

3. Depending upon the finish floor elevation, a combination of partial undercut, backfill and subgrade lime-stabilized can be utilized. In such circumstances, we recommend having at least four (4)-feet of cushion of select fill (below the slab) placed on the top of at least 12-inches of lime stabilized subgrade soils to limit the potential vertical rise to permissible limit of 1-inch.

Alternatively, based on existing or dry moisture condition we recommend that the floor slabs be separated from the on-site expansive soils using select structural fill. The fill thickness must be verified after the completion of the proposed structural pad. The relationship between estimated PVR and thickness of select fill replacement below existing grade is presented in the following table.

Estimated PVR (Dry Moisture Condition) vs. Thickness of Replacement Fill (Undercut)	
Thickness of the Structural Fill below the Existing Grade	PVR (in)
0	3.99
24	2.20
48	1.5
96	1.0

6.4.3 Slab on Fill Important Construction Considerations

1. Backfill adjacent to exterior footings, foundation walls, grade beams and pile caps and within 8 inches of final grade should comprise low-plastic cohesive fill with Plasticity Index minimum of 30. If a sidewalk is proposed around the building, impervious clay layer is not required as the sidewalk is to limit infiltration into the fill soils. Rainwater infiltration through the fill soils will create bath-tub effects (perched water conditions) under the slab. Earth Engineering should notify to inspect the impervious clay layer during construction.

2. The fill soils placed on the site should consist of low plasticity sandy clays with plasticity indices (PI's) ranging between 12 and 20. Sands, or silts, are not considered fill and, therefore, should not be used in lieu of sandy clays. The fill soils should be placed in loose eight (8) inch lifts and compacted to 95% of the maximum density as determined by ASTM D-698. The moisture contents of the structural fill should be within ± 3 percent of the optimum moisture content.

3. The floor slab should be installed as soon as the structure pad is prepared. The slab should be protected from inclement weather at all

times by providing proper drainage and placing plastic sheeting on top of the slab. If the structure pad is left exposed to rainfall, perched groundwater conditions may develop which will undermine the integrity of the floor slab. Therefore, the floor pad should be covered with a plastic sheet, if the floor slab is not placed immediately.

4. In the event that the floor slab is not installed after structural slab is prepared, the in-situ slab densities must be retested at several locations within the slab areas prior to slab placement. All densities must be at least 95% of the maximum dry density and the optimum moisture contents should be with ± 3% of the optimum moisture content. If the densities fail, then the deeper layers must also be retested. All the failed areas must be excavated, aerated or chemically stabilized, then placed in eight (8) inch loose lift and re-compacted to 95% of maximum dry density and within ±3% of optimum moisture content.

5. All trenches (sanitary, water, cable, electrical) should be properly backfilled and compacted to 95% of the maximum dry densities. Sand or other permeable materials should not be used as backfill. Improperly backfilled and improperly compacted trenches, if left exposed, can also lead to the development of perched groundwater conditions. In general, perched water tends to be trapped within the fill. The trapped groundwater tends to soften the subgrade. The excess moisture promotes clay expansion (heave) which may be a detriment to the integrity of the slab foundation and structure. Positive drainage should be maintained across the entire structure pad.

6. Clay plugs must be utilized at the entrance and exit of all pipes under the building area to prevent water intrusion into the slab bedding soils. Plumbing leak tests should be performed periodically to detect any leaks within the system.

6.5 Grade Beams Associated with Drilled Piers

We recommend extending the exterior and interior grade beams to a depth of 24 inches below the final grade at the site. A system of grade beams can be incorporated in the design of the slab at the discretion of the structural engineer. The number and the dimension of the grade beams are also left to the discretion of the structural engineer.

The project team (Architect, Structural Engineer, Project Manager, Contractor, and the Owner) must recognize that poor drainage, plumbing leakages, sanitary sewer leakages, and sprinkler systems around the structures are potential sources of moisture that could easily migrate under the exterior grade beams into the slab area. This type of excess moisture promotes clay expansion (heave), which may be detrimental to the integrity of the slab, foundation, and structure.

6.6 Flatwork

Flatwork (such as sidewalks, ramps, etc.) outside the building area will be sensitive to movement; therefore, subgrade preparations should be implemented similarly as for slab area. Proper preparation of the flatwork subgrade will help in minimizing differential movements between the building and the flatwork adjacent to the building.

If the flatwork subgrade is not installed like the building slab, these areas will be susceptible to post-construction movements (larger PVR values), which may then result in reversed drainage patterns that direct run-off towards the structure(s).

6.7 Lifetime Maintenance and Construction Considerations

6.7.1 Site Drainage

The site should be graded in such a manner as to channel all rainwater away from the structure. Water should not be allowed to pond around the structure. Positive site drainage will reduce the exposure of the on-site clays to moisture, thus eliminating potential swelling of the on-site clays.

The exposed, unpaved ground should be sloped away from the structure at a minimum grade of 5% and should extend at least 10 feet beyond the perimeter of the building upon completion of construction and landscaping. We recommend verifying the final grades to ensure that effective drainage has been achieved.

The grading around the structure should be periodically inspected and adjusted as necessary, as part of the maintenance program. Positive site drainage should be maintained throughout the lifespan of the structure.

6.7.2 Plumbing

Due to the presence of sandy clayey soils, installing a watertight plumbing system is critical. Water leakage due to poor plumbing will have detrimental effects on the performance of the structure and foundation. Plumbing leakage tests should be performed periodically to detect any leaks within the system before irreversible damage to the foundation is caused.

6.7.3 Roof Gutters and Downspouts

Roof gutters should be utilized to direct roof runoff away from the structure. Downspouts should not be allowed to discharge near the structure. Downspout extensions should be used to facilitate rapid rainwater discharge away from the structure. Ideally, the downspouts should be directly connected to the storm sewer system.

6.7.5 Landscaping

Landscaping and irrigation should be minimized as much as possible around the structure. Plants located within 10 feet of the structure should be self-contained to prevent water from infiltrating into the subgrade soils located beneath the building and pavement. The sprinkler mains and spray heads should be installed at a minimum distance of 7-10 feet away from the building lines. Low volume, drip-style irrigation systems should not be used in the vicinity of the building.

6.7.6 Structural Design Considerations

The floor slabs should be provided with a moisture barrier to prevent migration of the capillary moisture through the slab. Fifteen (15)-mill Visqueen can be used.

6.8 As-Built Survey Elevations

It is highly recommended to measure elevations of the existing slab and surrounding areas. Also, establish a benchmark elevation for future reference.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Site Preparation

- **Based on the boring log B-3, soft to firm sandy silty clay fill soils were encountered at the surface and extending at a depth of 8 feet. Based on site reconnaissance and review of Google Earth, a underground drainage is existing at the boring -3 location. It is possible the utility was loosely backfilled with sandy silty clay soils. If encountered, soft soils should be removed from the slab areas and replaced with compacted select fill soils.**

- Soft soils should be removed until firm soil is reached. The soft soils can be aerated and placed back in eight-inch loose lifts and compacted to 95% as specified by ASTM D-698 and within ±3 of optimum moisture content.

- Tree stumps, tree roots, and any existing structures and pavement should be removed from the site area. If the tree stumps and roots are left in place, settlement and termite infestation may occur. Once a root system is removed, a void is created in the subsoil. It is recommended to fill these voids with structural fill or cement-stabilized sand and compact to 95% as specified by ASTM D-698 and within ±3 of optimum moisture content.

- Depending on the virgin site conditions, organic is found at depths of 2 to 2.5 feet below the existing grades. All organic materials should be scarified and removed before subgrade preparation.

- **Any low-lying areas including ravines, ditches, swamps, etc. should be filled with structural fill and placed in eight-inch lifts**. Each lift should be compacted to 95% of the maximum dry density as specified by ASTM D-698 and within ±3 of optimum moisture content.

- The exposed subgrade should be scarified to a minimum depth of six (6) inches in the driveway and slab areas. The subgrade should then be compacted to 95% of the maximum density as determined by the Standard Moisture Density Relationship (ASTM D-698) and within ±3 of optimum moisture content.

- A sheep-foot roller should be utilized to compact the fill soils. A smooth-drum compactor should then be utilized to seal the compacted fill. If the upper six-(6) inches cannot be compacted due to excessive moisture, we recommend that these soils be excavated and removed or chemically stabilized to provide a firm base for fill placement.

- Proof rolling should be performed using a heavy tired loaded truck or pneumatic rubber-tired equipment weighing about 15 to 20 tons.

- The fill soils placed on the site should consist of low plasticity sandy clays with plasticity indices ranging between 12 and 20.

- Sands or silts are not considered fill and therefore, should not be used instead of sandy clays.

- The fill soils should be placed in loose eight-inch lifts and compacted to 95% of the maximum density as determined by ASTM D-698 and within ±3 of optimum moisture content.

- The floor slab should be placed as soon as possible after the building pad is prepared. If the building pad is left exposed to rainfall, perched groundwater conditions may develop which will undermine the integrity of the floor slab. All trenches (sewer, water, cable, electrical) should be properly backfilled and compacted to 95% of the maximum dry densities.

- Sand or permeable materials should not be used as backfill. Improperly backfilled and improperly compacted trenches, if left exposed, can result in perched groundwater conditions at the site. Perched groundwater conditions are highly undesirable Perched water tends to get trapped within the fill which then leads to softening of the subgrade and undermines the stability of the foundation. Positive drainage should be maintained across the entire building pad.

- A qualified soil technician should monitor all earthwork operations. Field density tests should be conducted on each lift using a nuclear density gauge. The gauge should be calibrated every day.

- Before field density tests, a 50-pound sample from the subgrade soils should be obtained. A similar sample should be obtained from the fill soils. A Standard Moisture Density Relationship (ASTM D-698) should be performed on each sample to obtain optimum moisture content and a maximum dry density. The field density tests should be compared to these results every time the soils are tested in the field.

The above recommendations apply to slabs, driveways, pavements, and any structures that are supported directly on-grade.

7.2 Site Drainage

Site drainage should be established during the first phase of construction. Water should not be allowed to collect or pond on the construction site. The site should be graded in such a manner to shed all rainwater away from the structure and foundation. *Positive site drainage should be maintained throughout the life of the structure.*

7.3 Drilled Pier Excavations

The field exploration was conducted on February 2th, 2024. Groundwater **was** encountered from 5 feet 15 feet below existing grade during drilling operations. Please refer to Section 5.3 for details. However, it should be noted that the groundwater level usually fluctuates with seasonal moisture conditions.
Therefore, the groundwater level may rise upward several feet during the rainy season. It is highly recommended to perform five (5) test piers (one in the center and one at each corner) before construction to verify the following:

- **the most current groundwater conditions just before construction**
- **the stability of the under-ream and shaft**
- **verify the presence of sand layers or thick sand seams**

An experienced drilling contractor should perform drilled and under-reamed pier excavations. The piers should be checked for levelness to prevent eccentric loading conditions. The belling bucket should be checked before the commencement of drilling to assure the right bell size. It is of prime importance that the bells are clear of loose materials and soil cuttings. To prevent concrete segregation and bearing area disturbance, it is recommended to use a tremie to pour the concrete if the depth of the pier exceeds eight (8) feet.

Soil stratigraphy and groundwater level may vary within the proposed construction site. Therefore, it is recommended to install four (4) corner piers and one (1) center pier before construction begins to verify the groundwater level and soil stratigraphy. The depths of the other piers may be adjusted accordingly.

Piers should not be allowed to remain open for an extended period or overnight. If pier excavation and backfilling with concrete cannot be completed the same day, the pier should be backfilled with excavated soils and re-excavated when excavation and concrete placement can be completed on the same day.

7.4 Installation for Drilled Piers with High Groundwater

Due to the presence of groundwater at the range of 5 feet 15 feet below the existing grade, we strongly recommend that the foundation contractor to adhere to the following drilled piers installation procedure:

1. Drill the hole to 24-inches above the final bell elevation. – **DO NOT BELL THE HOLE UNLESS THE CONCRETE IS READY TO POUR.**

2. Once the concrete is ready to pour, bell the hole to the desired elevation and pour the concrete immediately.

We highly recommend drilling five (5) test piers as mentioned above and several other locations in this report. If during the test piers construction, the contractor still faces difficulties drilling due to high groundwater or caving while belling, the contractor should stop drilling and the owner must call Earth Engineering for possible solution.

7.5 Inclement Weather Conditions

Earthwork contractors should be made aware of the moisture sensitivity of the near surface clayey soils and potential compaction difficulties. If construction is undertaken during wet weather conditions, the surficial soils may become saturated, soft, and unworkable. Drainage trenches within the soils to be excavated, reworked and/or recompacted may be needed.

Additionally, subgrade treatment techniques, such as chemical (lime or lime-fly ash) treatment, may be needed to provide a more weather resistant working surface during pad construction.

We recommend that consideration be given to construction during drier months. Alternatively, the Contractor should protect exposed areas once topsoil or existing pavement has been stripped, as well as provide positive drainage during earthwork operations.

8.0 DESIGN REVIEW

EARTH ENGINEERING, INC. should be allowed to review the construction design documents before releasing for a bid to assure that our recommendations are interpreted as intended in our report. If we are not allowed to review the final documents, EARTH ENGINEERING, INC. will not be responsible for misinterpretations of our recommendations by other parties. The design review is not part of our scope of work and would be an additional charge.

9.0 LIMITATIONS

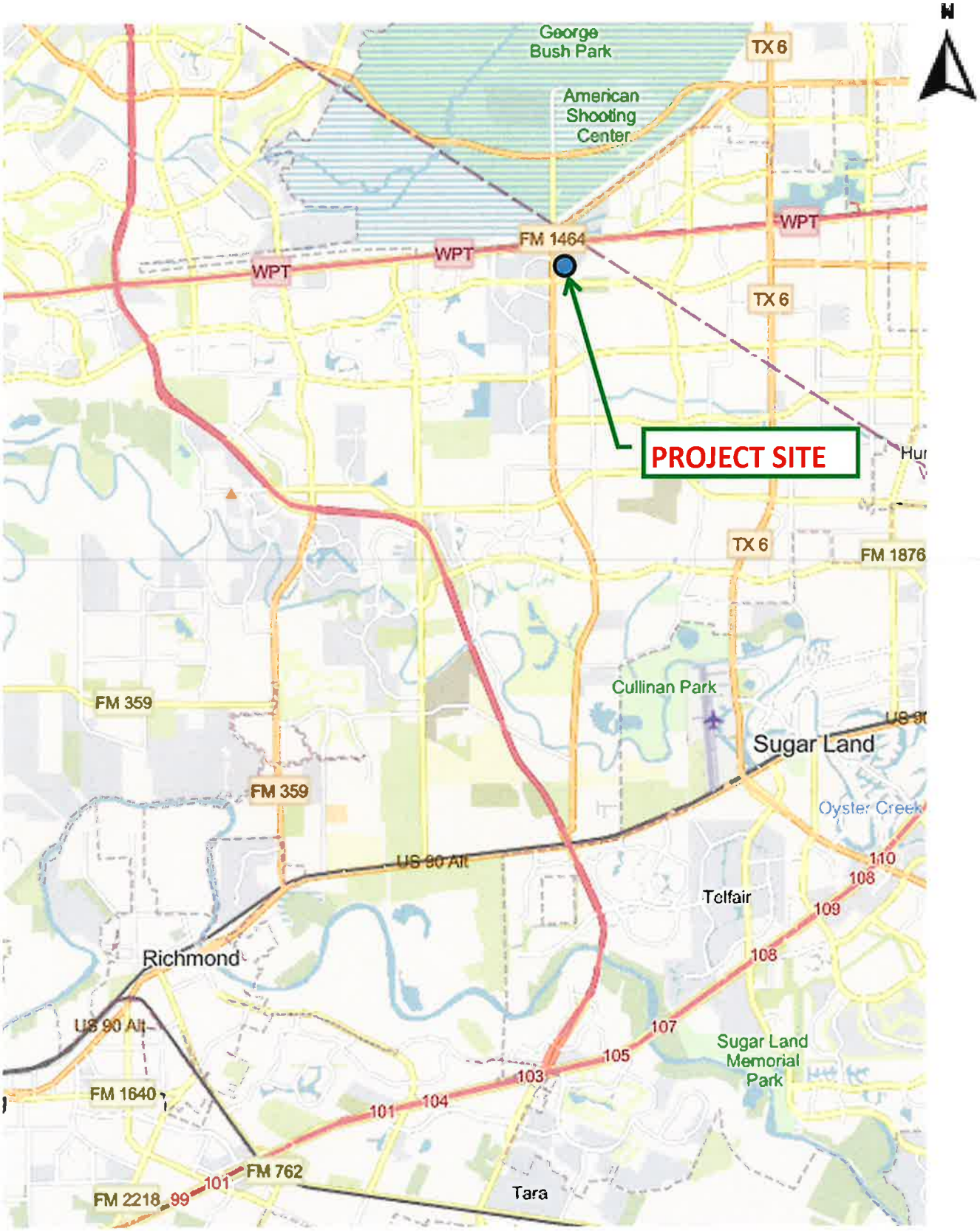
Our site exploration was based on four (4) borings at select locations. Soil stratigraphy may change within the site. If different soil conditions are encountered in the field, EARTH ENGINEERING, INC. should be immediately notified. It should be noted that a fault study is not within the scope of work. This study was performed following generally accepted geotechnical engineering practices for design purposes only under the supervision of a licensed professional engineer in the State of Texas. Foundation recommendations presented herein are valid for one (1) year from the date of the report. After one (1) year, Earth Engineering, Inc. should be contacted to verify the validity of the recommendations before construction.

If any changes in the nature, design, or location of the proposed building are made, the conclusions or recommendations presented in this report are not valid until the changes are reviewed by EARTH ENGINEERING, INC. and the conclusions and recommendations are modified in writing.

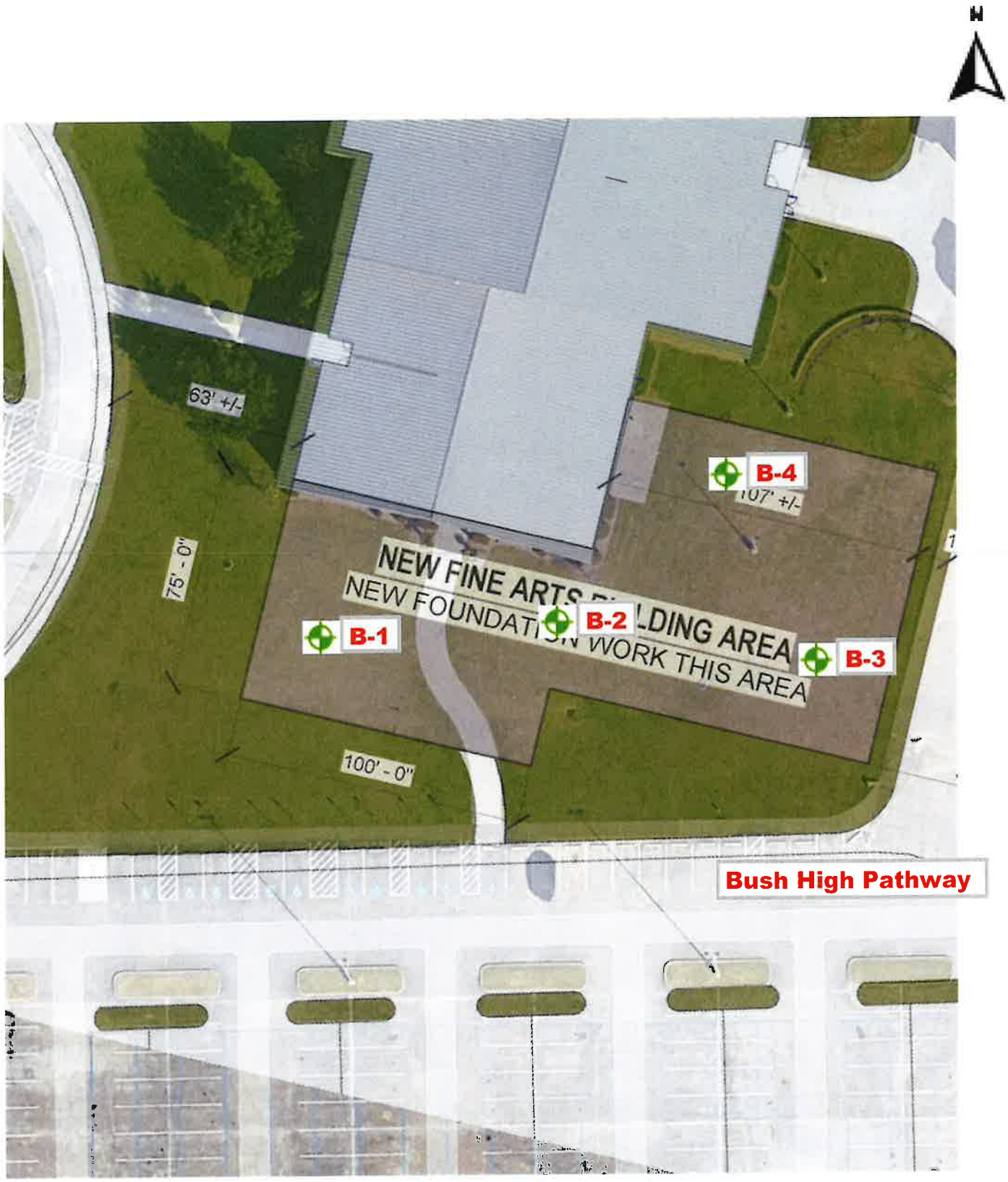
10.0 CONSTRUCTION MATERIALS TESTING

Quality control (QC) is extremely important in the construction industry. A quality control program should be initiated at the beginning of the project. The program should be designed by an accredited laboratory to cover all stages of construction from the ground up. EARTH ENGINEERING, INC. would be pleased to provide you with a proposal for these services:

- Soil Compaction (fill under-slab, utility backfill, etc.)
- Soil Stabilization (lime or lime/fly-ash)
- Foundation Inspection and Monitoring (drilled piers, drilled shafts, auger cast piles, spread footings, driven piles and spread footings)
- Concrete Inspection & Monitoring
- Rebar Inspection
- Structural Steel Welding Visual Inspection and Non-Destructive Testing
- Maturity Probes and Thermocouplers to Measure Concrete Temperature and Strength



SITE LOCATION	EARTH ENGINEERING INC	
PROPOSED FINE ARTS BUILDING ADDITION AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464 RICHMOND, TX 77407	Geotechnical, Environmental and Material Testing	
	Scale: N.T.S.	Date: 2/29/2024
	Project: EE-2411101-G	Plate: 1



BORING LOCATIONS	EARTH ENGINEERING INC Geotechnical, Environmental and Material Testing	
PROPOSED FINE ARTS BUILDING ADDITION AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464 RICHMOND, TX 77407	Scale: N.T.S.	Date: 2/29/2024
	Project: EE-2411101-G	Plate: 2

LOG OF BORING: B-1 (Coord: 29.704576, -95.685676)

Project: Proposed Fine Arts Building Addition
Client: Fort Bend Independent School District
Location: 6707 FM 1464, Richmond, TX 77407
Driller: JM Drilling
Easting: **Northing:**

Project NO.: EE-2411101-G
Drilling Depth (ft): 20
Elevation (ft):
Logged By: Jeff
Weather:

DEPTH (ft)	GRAPHIC LOG	SAMPLERS	Description Surface Elevation: Existing	USCS	PPEN (tsf)	SPT (Blows/ft)	M. Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Cohesion (KSF)	Dry Density (PCF)	<#200 Sieve
0			FILL: FAT CLAY (CH), firm, dry, gray, with roots fibers, sand seams and layers	FILL	1.0		18	80	24	56			68
2			SANDY LEAN CLAY (CL), stiff, dry, gray, light brown	CL	2.5								
4			--very stiff below 4 feet		4.0		12	44	18	26			
6			--with calcareous nodules below 6 feet		3.5								
8			--stiff, reddish brown, gray below 8 feet		2.5		17	48	18	30			
10													
12					2.5								
14 ▼													
16													
18			-dry to moist below 18 feet		2.0								
20			Boring terminated at 20 feet.										

Test Result Curves
Plastic Limit △
Liquid Limit ○
Blow Counts ◇
Moisture Content ●
15 30 45 60 75

PPEN Curve
1 2 3 4

This information pertains only to this boring location and should not be interpreted as being indicative of the whole site

WATER LEVEL MEASUREMENTS (ft.)

Initial: 17 feet

After 15 mins: 15 feet

DATE DRILLED: 2/4/2024

Plate: 3

EARTH ENGINEERING, INC.
4877 Langfield Rd. Houston, TX 77040

Geotechnical, Materials Testing & Environmental Consultants.
Phone:713-681-5311 Fax:713-681-5411 www.eartheng.com

LOG OF BORING: B-2 (Coord: 29.704590, -95.685409)

Project: Proposed Fine Arts Building Addition
Client: Fort Bend Independent School District
Location: 6707 FM 1464, Richmond, TX 77407
Driller: JM Drilling
Easting: **Northing:**

Project NO.: EE-2411101-G
Drilling Depth (ft): 20
Elevation (ft):
Logged By: Jeff
Weather:

DEPTH (ft)	Description Surface Elevation: Existing	USCS	PPEN (tsf)	SPT (Blows/ft)	M. Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Cohesion (KSF)	Dry Density (PCF)	<#200 Sieve
0	FILL: SANDY LEAN CLAY (CL), firm, dry, gray, with roots fibers	FILL	1.5		21	46	18	28			
2	--with sand seams and layer at 2 to 4 feet		1.0								
4	FAT CLAY (CH), very stiff, dry, gray, light brown with calcareous nodules	CH	4.0		16	51	19	32			
6			3.0								
8	--reddish brown, gray below 8 feet		3.5		23	53	19	34			
10											
12											
14	--with calcareous nodules below 13 feet		3.5								
16											
18			3.5								
20	Boring terminated at 20 feet.										

Test Result Curves: Plastic Limit △, Liquid Limit ○, Blow Counts ◈, Moisture Content ●; 15 30 45 60 75

PPEN Curve: 1 2 3 4

This information pertains only to this boring location and should not be interpreted as being indicative of the whole site

WATER LEVEL MEASUREMENTS (ft.)

Initial: 17 feet

After 15 mins: 15 feet

DATE DRILLED: 2/4/2024

Plate: 4

EARTH ENGINEERING, INC.
4877 Langfield Rd. Houston, TX 77040

Geotechnical, Materials Testing & Environmental Consultants.
Phone:713-681-5311 Fax:713-681-5411 www.eartheng.com

LOG OF BORING: B-3 (Coord: 29.704555, -95.685165)

Project: Proposed Fine Arts Building Addition
Client: Fort Bend Independent School District
Location: 6707 FM 1464, Richmond, TX 77407
Driller: JM Drilling
Easting: **Northing:**

Project NO.: EE-2411101-G
Drilling Depth (ft): 20
Elevation (ft):
Logged By: Jeff
Weather:

DEPTH (ft)	Description Surface Elevation: Existing	USCS	PPEN (tsf)	SPT (Blows/ft)	M. Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Cohesion (KSF)	Dry Density (PCF)	<#200 Sieve
0	FILL: SANDY SILTY CLAY (CL-ML), firm, dry, gray, with roots fibers	FILL	1.5								
2	--with sand seams and layers below 2 feet		1.5		16	22	14	8			
4 ▼			1.5		22	24	15	9			23
6 ▽	--dry to moist below 6 feet		1.5								
8	SANDY SILTY CLAY (CL-ML), firm, wet, gray, with roots fibers	CL-ML	1.5								
10											
12											
14			1.25								
16											
18	FAT CLAY (CH), stiff, wet, gray, with roots fibers	CH	2.0								
20	Boring terminated at 20 feet.										

Test Result Curves: Plastic Limit △ Liquid Limit ○ Blow Counts ◈ Moisture Content ●
15 30 45 60 75

PPEN Curve: 1 2 3 4

This information pertains only to this boring location and should not be interpreted as being indicative of the whole site

WATER LEVEL MEASUREMENTS (ft.)

▽ **Initial:** 7 feet

▼ **After 15 mins:** 5 feet

DATE DRILLED: 2/4/2024

Plate: 5

EARTH ENGINEERING, INC.
4877 Langfield Rd. Houston, TX 77040
Geotechnical, Materials Testing & Environmental Consultants.
Phone:713-681-5311 Fax:713-681-5411 www.eartheng.com

LOG OF BORING: B-4 (Coord: 29.704726, -95.685219)

Project: Proposed Fine Arts Building Addition
Client: Fort Bend Independent School District
Location: 6707 FM 1464, Richmond, TX 77407
Driller: JM Drilling
Easting: **Northing:**

Project NO.: EE-2411101-G
Drilling Depth (ft): 20
Elevation (ft):
Logged By: Jeff
Weather:

DEPTH (ft)	Description Surface Elevation: Existing	USCS	PPEN (tsf)	SPT (Blows/ft)	M. Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Cohesion (KSF)	Dry Density (PCF)	<#200 Sieve
0	FILL: SANDY LEAN CLAY (CL), firm, dry, gray, with roots fibers	FILL	1.5		20	40	17	23			
2			1.0								
4	FAT CLAY (CH), very stiff, dry, gray, light brown	CH	4.0								
6	--stiff, with calcareous nodules at 6 to 8 feet		2.5		17	54	19	35			82
8	--very stiff below 8 feet		4.0		25	63	21	42			
10											
12											
14	--reddish brown, gray below 13 feet		3.0								
16											
18			3.0								
20	Boring terminated at 20 feet.										

Test Result Curves: Plastic Limit △, Liquid Limit ○, Blow Counts ◈, Moisture Content ●
15 30 45 60 75

PPEN Curve: 1 2 3 4

This information pertains only to this boring location and should not be interpreted as being indicative of the whole site

WATER LEVEL MEASUREMENTS (ft.)

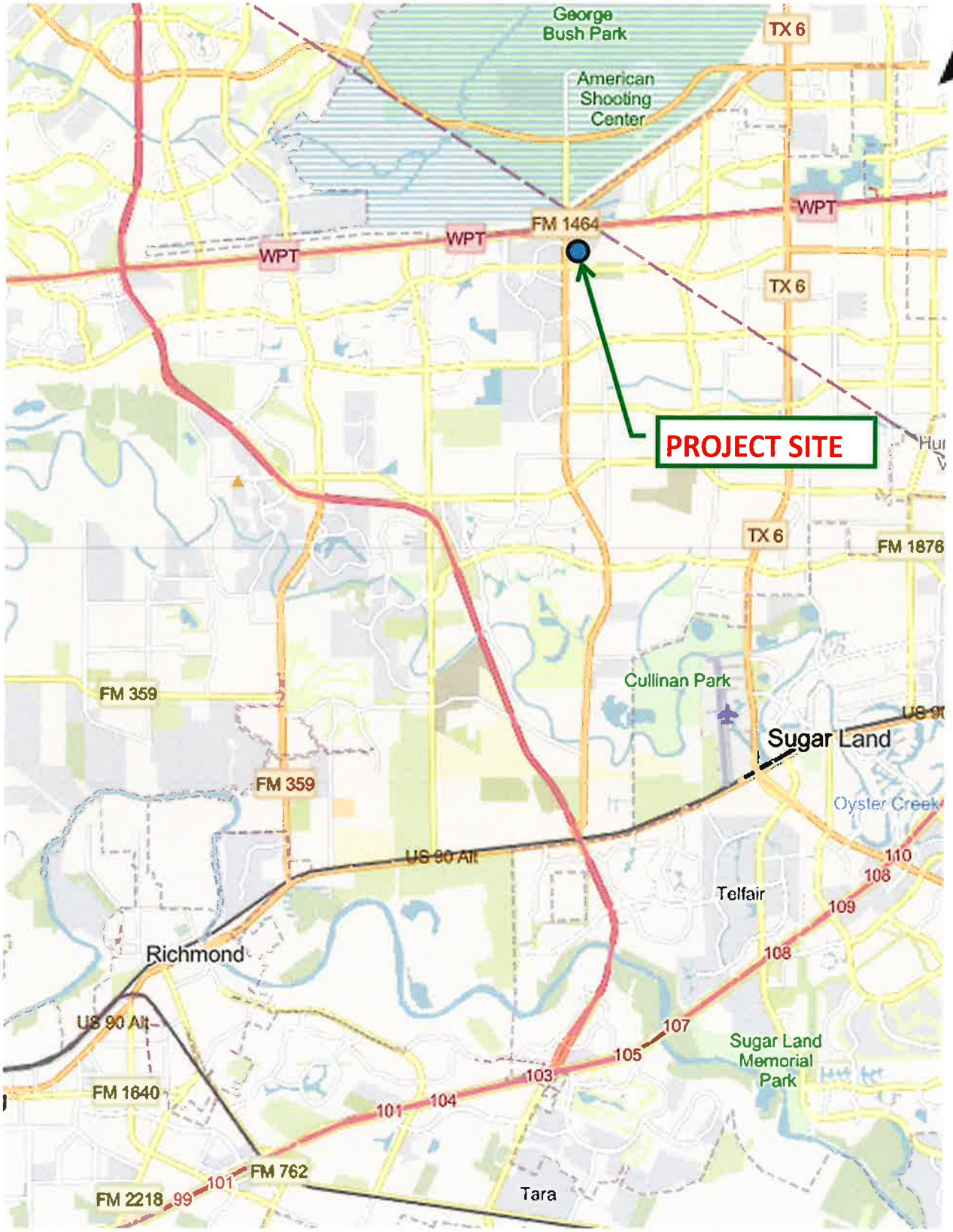
Initial: 17 feet

After 15 mins: 15 feet

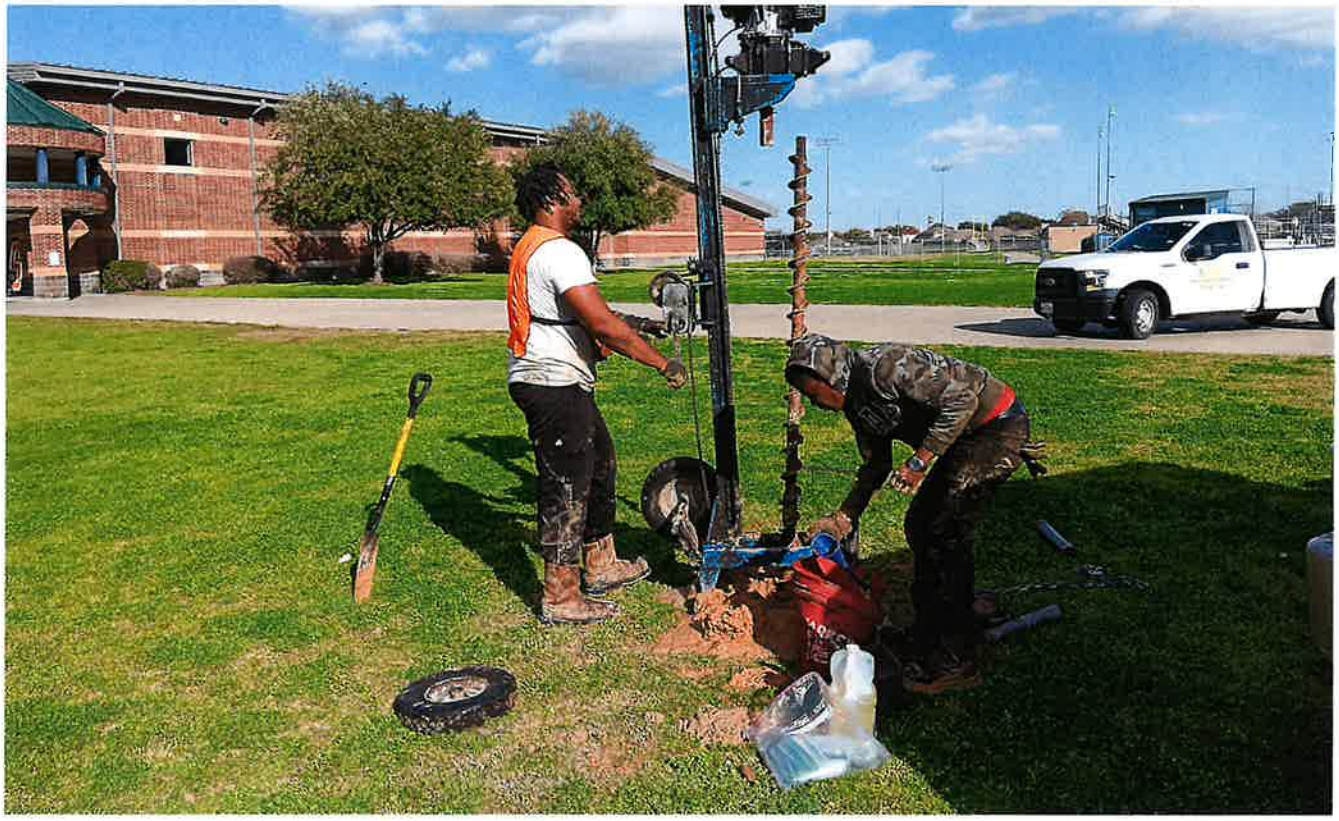
DATE DRILLED: 2/4/2024

Plate: 6

EARTH ENGINEERING, INC.
4877 Langfield Rd. Houston, TX 77040
Geotechnical, Materials Testing & Environmental Consultants.
Phone:713-681-5311 Fax:713-681-5411 www.eartheng.com



SITE LOCATION	EARTH ENGINEERING INC	
PROPOSED FINE ARTS BUILDING ADDITION AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464 RICHMOND, TX 77407	Geotechnical, Environmental and Material Testing	
	Scale: N.T.S.	Date: 2/29/2024
	Project: EE-2411101-G	Plate: 1



SITE PICTURES

PROPOSED FINE ARTS BUILDING ADDITION AT GEORGE BUSH HIGH SCHOOL – 6707 FM 1464 RICHMOND, TX 77407

EARTH ENGINEERING INC

Geotechnical, Environmental and Material Testing

Scale: N.T.S.	Date: 2/29/2024
Project: EE-2411101-G	Plate: 8

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Fort Bend Independent School District
16431 Lexington Boulevard
Sugar Land, Texas 77479

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[X] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[X] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)
Attached as Exhibit E		

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

$1,000.00 per calendar day that substantial completion is delayed.
$250.00 per day for each calendar day for non-completion of punch list items and contract close-out within 60 days after substantial completion

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 25th day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 22nd day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Thirty One (31) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Five Percent (5%)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

At the Owner's sole discretion

(Paragraphs deleted)
§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment
§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest
Payments due and unpaid under the Contract shall bear interest in accordance with Chapter 2251 of the Texas Government Code, except when disputed in accordance with Chapter 2251 of the Texas Government Code.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Carolina Fuzetti, MS, PMP
Executive Director, Design & Construction
Fort Bend Independent School District
2323 Texas Parkway
Missouri City, TX 77489
281 634-5592

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 Attached as Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, as amended by the Owner.

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date
Attached as Exhibit D		

.6 Specifications

Section	Title	Date	Pages
Attached as Exhibit C			

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Exhibit A: Insurance and Bonds
B: CSP Negotiated Items
C: Specifications Table of Contents
D: List of Drawings
E: Unit Prices
F: Warranty Letter

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
Dr. Christie Whitbeck, Superintendent Fort Bend Independent School District	.
(Printed name and title)	*(Printed name and title)*

Additions and Deletions Report for
AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:50:02 ET on 03/31/2022.

PAGE 1

Fort Bend Independent School District
16431 Lexington Boulevard
Sugar Land, Texas 77479

PAGE 2

[X] A date set forth in a notice to proceed issued by the Owner.

PAGE 3

[X] By the following date:

...

Attached as Exhibit E

...

$1,000.00 per calendar day that substantial completion is delayed.
$250.00 per day for each calendar day for non-completion of punch list items and contract close-out within 60 days after substantial completion

PAGE 4

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 25th day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 22nd day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Thirty One (31) days after the Architect receives the Application for Payment.

...

Five Percent (5%)

PAGE 5

At the Owner's sole discretion

~~**§ 5.1.7.3** Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:~~
~~*(Insert any other conditions for release of retainage upon Substantial Completion.)*~~

...

Payments due and unpaid under the Contract shall bear interest ~~from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~in accordance with Chapter 2251 of the Texas Government Code, except when disputed in accordance with Chapter 2251 of the Texas Government Code.

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[**X**] Litigation in a court of competent jurisdiction

...

Carolina Fuzetti, MS, PMP
Executive Director, Design & Construction
Fort Bend Independent School District
2323 Texas Parkway
Missouri City, TX 77489
281 634-5592

PAGE 7

.2 ~~AIA Document A101™–2017,~~ Attached as Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for ~~Construction~~Construction, as amended by the Owner.

...

Attached as Exhibit D

...

Attached as Exhibit C

PAGE 8

Exhibit A: Insurance and Bonds
B: CSP Negotiated Items
C: Specifications Table of Contents
D: List of Drawings
E: Unit Prices
F: Warranty Letter

...

Dr. Christie Whitbeck, Superintendent
Fort Bend Independent School District .

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:50:02 ET on 03/31/2022 under Order No. 2114291871 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

Fort Bend Independent School District
16431 Lexington Boulevard
Sugar Land, Texas 77479

THE ARCHITECT:
(Name, legal status and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

Init.
/

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Performance Bond, Labor and Material Payment Bond, Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to propose, instructions to Proposers, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's Proposal or portions of Addenda relating to proposal requirements).

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents. Nothing in these Conditions shall be interpreted as imposing on either the Owner or the Architect, or their respective agents, employees, officers, directors or consultants, any duty, obligation or authority with respect to any items that are not intended to be incorporated into the completed Project, or that do not comprise the Work, including, without limitation, shoring, scaffolding, hoists, weatherproofing, or any temporary facility or activity, since these are the sole responsibility of the Contractor.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.1.2 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as "1".

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A101-2017)
.
.3 The General Conditions of the Contract for Construction
.4 Addenda, with those of later date having precedence over those of earlier date
.5 Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitating avoiding increase in the Contract cost. If an item is shown one place in the Drawings, but no another, or called for in a schedule or the specifications but not shown on the Drawings, or shown on the Drawings but not in a schedule, it is to be included. Existing conditions take precedence over Drawings and Specifications for dimensions.

§ 1.2.1.3 Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 In the case of inconsistency within or between the Drawings and Specifications discovered prior to Proposal Submission Time but too late to be clarified by an Addendum, the better quality or greater quantity of Work shall be included in the Proposal. Clarification of any inconsistency will be accomplished with the Contractor after award of Contract and, if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

§ 1.2.5 Product and Reference Standards. When specific products, systems or items of equipment are referred to in the Contract Documents, any ancillary devices which the Contractor knows, or in accordance with the standard of care for a Contractor should have known, is necessary for proper functioning shall also be provided. When standards, codes, manufacturer's instructions and guarantees are required and no edition is specified by the Contract Documents, the current edition at the time of Contract execution shall apply whether or not the proper edition was set out in the Contract Documents. References to standards, codes, manufacturer's instructions and guarantees shall apply in full, except:

.1 They do not supersede more stringent standards set out in the Contract Documents, and
.2 any exclusions or waivers that are inconsistent with the Contract Documents do not apply.

§ 1.2.6 Relations of Specifications and Drawings. General Requirements in the Specifications govern the execution of all Work. Summary paragraphs present a brief indication of the Work, but do not limit the Work as later detailed. Should the Drawings and Specifications have internal inconsistencies, then the Contractor shall base the bids and construction on the most expensive combination of quality and quantity of work indicated. For purposes of construction, the Architect shall determine the appropriate Work, after the Contractor brings the inconsistency to the Architect's attention. Failure to report an inconsistency shall be evidence that Contractor has elected to proceed in the more expensive manner.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served on the next business day.

(Paragraph deleted)

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§1.9 Miscellaneous Other Definitions

§1.9.1 Addenda, Addendum. Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

§1.9.2 Alternate Proposal(s). A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

§1.9.3 Approved, Approved Equivalent, Approved Equal, or Equal. The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.4.2, Substitution of Products and Systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of proposals is described in the Instructions to Bidders.

§1.9.4 Base Proposal. The Contractor's proposal for the Work, not including any Alternates.

§1.9.5 Contract Time. The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments as enumerated in the Contract Documents.

§1.9.6 Date of Agreement. The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

§1.9.7 Date of Commencement of the Work. The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

§1.9.8 Date of Final Completion. The end of construction. See AIA Document A201, Section 9.10.

§1.9.9 Day. The following days are referenced in the documents:

.1 **Calendar Days**: The Contract Time is established in Calendar Days and extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.2 **Holidays:** The days officially recognized by the construction industry in this area as a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after and Christmas Day.

.3 **Regular Work Days:** All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).

.4 **No extensions of the Contract Time will be granted due to inclement weather except as stated in Section 8.3.1.**

§ 1.9.10 Final Completion. Achieved after the Work has been completed by the Contractor, the final inspection has been performed by the Architect and the Owner, the Contract Closeout process has been completed, and the final Certificate for Payment has been issued by the Architect to the Owner. See Sections 1.1.14 and 9.10 and Specification sections regarding Contract Close Out.

§1.9.11 Notice to Proceed. A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

§ 1.9.12 The Project Manual. A volume assembled for the Work which may include the Proposal requirements, sample forms, Conditions of the Contract, Drawings and Specifications.

§ 1. 9.13 Proposal. A complete and properly signed proposal to do the Work for the sums stipulated therein, submitted

on the prescribed forms in accordance with the Proposal Documents.

§ 1.9.14 Proposal Documents. All documents and bound into or referenced in the Project Manual, the Drawings, and Addenda related thereto. The Project Manual contains the Proposal requirements, Contract and other forms, Conditions of the Contract, the Specifications, and a list of Drawings and Schedules, some of which are bound into the Project Manual (other Drawings and Specifications are bound separately).

§ 1.9.15 Proposer. A person or entity who submits a Proposal.

§**1.9.16 Provide.** Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

§**1.9.17 Punch List.** A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

§ 1.9.18 SMALL BUSINESS ENTERPRISE PROGRAM ("SBEP"). Owner has adopted the SBEP to provide increased business opportunities for locally certified small businesses to competitively participate in contracting and procurement within FBISD. *See* FBISD Board Policy CV(Local).

§ 1.9.19 SUB-PROPOSER. A person or entity who submits a Proposal to a Proposer for materials, equipment or labor for a portion of the Work.

§**1.9.20 Unit Prices.** A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark up by the Contractor or his subcontractors."

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the Board's approval under current policy of the Board of Trustees for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

(Paragraph deleted)

§ 2.1.2 The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to enter into a contract, to approve a Change Order requiring an increase in the Contract Sum, or agree to an extension to the contractual Completion Date, unless this authority is lawfully delegated. Neither Architect nor Contractor may reply upon the direction of any employee of Owner or Program Manager who has not been designated in writing by the Superintendent of Schools or Board of Trustees of Owner; Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

§ 2.1.3 The presence of the Owner, Program Manager or Architect at the Work site does not imply acceptance or approval of the Work.

§ 2.1.4 The Owner, being a public body under the laws of the State of Texas, must have funds in the full amount of the Contract on hand prior to award and execution of the Contract. Furthermore, no Contract exists between the Owner and the Contractor until the formation of the Contract is approved by a majority of the Board of Trustees of the Owner in open session at a duly held Board meeting, and the contract is signed by an authorized Owner's representative.

§ 2.1.5 At any time prior to the Owner's receipt of the executed Agreement with the required bonds and insurance, the Owner may, at its sole option and without cause, reject the offer described in this Agreement by delivering to the Contractor a written notice stating so. Such notice shall be signed by the Owner's Director of Purchasing or designee, and shall be effective on receipt by the Contractor. The rejection of the offer described in this Agreement, shall cause

no obligation or duty to the Owner save return of bid or proposal security, if any, if rejection is without cause. This section does not pertain to rejection for cause by the Owner, or for the Contractor's failure to provide require bonds or insurance.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.

(Paragraphs deleted)

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 The Contractor shall pay the cost of reproduction, postage, and handling of all sets of Drawings and Specifications necessary for the Contractor to execute the Work. If the Contractor requests in writing that the Architect and his Consultants update the original Drawings and Specifications to incorporate Addendum items, or Modifications, the Architect and his Consultants will do so at their expense. However, the Contractor shall pay the cost of reproduction, postage and handling of all sets of Drawings and Specifications necessary for the Contractor to execute the Work.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, after

receipt of written notice from the Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect, Program Manager and other consultants' additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within thirty (30) days of receipt of written notice from the Owner therefor.

§ 2.5.1 After the Work is complete the Owner may make emergency repairs to the Work if necessary to prevent further damage, or if the Contractor does not promptly respond to a notice of a condition requiring repairs. Contractor shall be responsible to Owner for this cost if the reason for the repairs is defects in Contractor's Work. If payments then or thereafter due the Contractor are not sufficient to cover such costs, the Contractor shall pay the difference to the Owner

§ 2.7 Owner's Right to Occupy the Project

§ 2.7.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not yet have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents. If the Contractor determines that said occupancy may cause a delay to the completion of the project, he shall notify the Owner in writing immediately.

§ 2.7.2 Refer to Article 11 Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

§ 2.7.3 If Contractor has not completed the obligations of the Contract Documents by the dates established by subsequent Amendments to the Agreement Between Owner and Construction Manager, the Owner shall have the right to occupy or use the entire project.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect or Program Manager in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing

conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

§ 3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation or initiating a Request for Information (RFI). The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work complies with the Contract Documents. The Contractor shall arrange meetings for the Architect, prior to commencement of the Work, with all major subcontractors, to allow the subcontractor to demonstrate his understanding of the documents to the Architect and to allow the subcontractor to ask for any interpretation he may require. Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 3.2.6 If, in the opinion of the Architect and the Program Manager, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

§ 3.2.7 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes, including substitutions of materials, shall be accomplished by appropriate Modification. If the Contractor fails to perform the obligations of Section 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

§ 3.2.8 Prior to performing any Work, and only if applicable, Contractor shall locate all utility lines as shown and located on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, electrical lines, including, but not limited to, all buried pipelines and buried telephone cables, and shall perform any Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines. In addition, Contractor shall independently determine the location of same. Contractor shall be responsible for any damage done to such utility lines, cables, pipes and pipelines during its construction work, and shall be responsible for any loss,

damage, or extra expense resulting from such damage. The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including

.1 the location, condition, layout and nature of the Project site and surrounding areas;
.2 generally prevailing climatic conditions;
.3 anticipated labor supply and costs;
.4 availability and cost of materials, tools and equipment; and
.5 other similar issues.

§ 3.2.9 Contractor shall be responsible for any damage done to such lines, cables, pipes and pipelines during its construction work resulting from its negligent conduct

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors. . It is understood and agreed that the relationship of Contractor to Owner shall be that of an independent Contractor. Nothing contained herein or inferable here from shall be deemed or construed to (1) make Contractor the agent, servant or employee of the Owner, or (2) to create any partnership, joint venture, or other association between Owner and Contractor. Any direction or instruction by Owner or any of its authorized representatives in respect to the Work shall relate to the results the Owner desires to obtain from the Work, and shall in no way affect Contractor's independent Contractor status described herein. As part of that responsibility, Contractor shall enforce the Owner's alcohol-free, drug-free, tobacco-free, harassment-free and weapon-free policies and zones, which will require compliance with those policies and zones by Contractors' employees, subcontractors, and all other persons carrying out the Contract. Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, while on Owner's property, to refrain from committing any criminal conduct, using tobacco products, possessing or drinking alcoholic beverages, possessing or using illegal drugs or any controlled substance, carrying weapons, speaking profane and/or offensive language, or engaging in any inappropriate interactions of any nature whatsoever with students, and teachers, staff and visitors, including talking, touching, staring or otherwise contributing to a hostile or offensive environment for Owner's students and staff. All areas of campus, other than the defined construction area, shall be off limits to Contractor's forces, unless their work assignment specifies otherwise. Contractor shall also require adequate and appropriate dress and identification of Contractor's employees, subcontractors, and all other persons carrying out the Work. The Contractor shall further ensure that no on-site fraternization shall occur between personnel under the Contractor's and Subcontractor's direct or indirect supervision and Owner's students or employees and the general public. Failure of an individual to adhere to these standards of conduct shall result in the immediate termination of the employment of the offending employee from all construction on any of Owner's property and immediate removal from the site.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

§ 3.3.5 Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring

procedures, in accordance with Texas Government Code, Section 2166.303 and Texas Health and Safety Code, Subchapter C, Sections 756.021, et seq. On trench excavations in excess of 5 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

§ 3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site, the work shall be supervised by a qualified employee of the Contractor.

§ 3.3.7 The Contractor shall review Subcontractor safety programs, procedures, and precautions in connection with performance of the Work. However, the Contractor's duties shall not relieve any Subcontractor(s) or any other person or entity (e.g., a supplier), including any person or entity with whom the Contractor does not have a contractual relationship, of their responsibility or liability relative to compliance with all applicable federal, state, and local laws, rules, regulations, and ordinances which shall include the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards. The foregoing notwithstanding, the requirements of this Section are not intended to impose upon the Contractor any additional obligations that the Contractor would not have under any applicable state or federal laws, including, but not limited to, any rules, regulations, or statutes pertaining to the Occupational Safety and Health Administration

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

.1 If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.

.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

.3 Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

.4 By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

.5 Substitution requests shall be submitted on the forms included herein and in accordance with the

process established in specification referring to Product Options and Substitutions.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

.1 State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

.2 State law prohibits weapons or firearms on school property.

.3 There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

.4 No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

.5 Background checks

Contractor must give advance notice to the Owner if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. The Owner may terminate this Agreement pursuant to Article 14 Termination if the Owner determines that the person or business entity failed to give notice as required by this section or misrepresented the conduct resulting in the conviction. This section requiring advance notice does not apply to a publicly held corporation. THE CONTRACTOR RELASES, INDEMNIFIES AND HOLDS HARMLESS THE OWNER FOR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH OWNER'S DRUG-FREE, ALCOHOL-FREE, WEAPON-FREE, HARASSMENT-FREE, AND TOBACCO-FREE ZONES OR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH CRIMINAL LAW.

§ 3.4.4 The Contractor shall disclose the existence and extent of any financial interests, whether director indirect, such Contractor may have in any Subcontractor or material supplier which the Contractor may propose for this Project.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new, unless the Contract Documents require or permit otherwise. The contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect cause by abuse, material alteration to the Work not executed by the Contractor, insufficient maintenance or maintenance not in compliance with written instructions therefor, operation not in compliance with written instructions therefor, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranties set out in this section are not exclusive of any other warranties or guarantees set out in other places in the Contract Documents or implied under applicable law.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.5.3 In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

§ 3.5.4 The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods) extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

§ 3.5.5 The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

§ 3.5.6 Contractor shall certify that the Project has been constructed in conformance with the Architect's or Engineer's plan, specifications, and Contract Documents, as modified from time to time pursuant to the terms of the Contract Documents. Contractor shall fully complete a "Certification of Project Completion" as required by 19 Texas Administrative Code Section 61.1036(c) (3) (F). The Contractor shall deliver to the Owner its written guarantee, in the form attached to this contract as Exhibit "F", guaranteeing all of the work under the contract to be free from faulty materials in every particular, and free from improper workmanship, and against injury except from proper and usual wear and tear; and agreeing to replace or re-execute without cost to the Owner such work as may be found to be improper, imperfect or of unsatisfactory material and/or workmanship, without cost to the Owner, and to make good all damage caused to other work or materials, or to the Owner's property, real and personal, due to such improper, imperfect or faulty material and/or workmanship, and/or due to the required replacement or re-execution. Such warranty periods shall be maintained notwithstanding that certain systems may be activated prior to Substantial Completion as required for the satisfactory completion of the project. This guarantee shall be made to cover a period of one (1) year from the date of Substantial Completion as certified by the Architect under this Contract. This guarantee must be furnished to the Owner and approved by it before acceptance and final payment is made.

Upon written notice from the Owner, the Contractor shall promptly remedy defects as covered by his guarantee. If Contractor does not respond to Owner's written notice, either by beginning corrective work or notifying the Owner in writing stating when work will begin, within ten (10) days of receipt, the Owner may take measures to correct the work himself and Contractor will be obligated to reimburse Owner's costs. If notice of defects covered by warranty is given in writing to the Contractor on a timely basis, the obligation to provide the warranty work may extend beyond the one year warranty period until the warranty defect is remedied and accepted by the Owner. The Contractor shall provide bond coverage to extend for the one (1) year period of the guarantee to insure performance under the terms of his obligation. The provisions of this section shall be in addition to, and not in lieu of, any other rights and remedies available to the Owner.

§ 3.5.6.1 All required warranties on equipment, machinery, materials, or components shall be submitted to the Architect and Program Manager on the manufacturer's or supplier's approved forms at the time of Substantial Completion.

§ 3.5.6.2 When deemed necessary by the Owner and prior to installation of any item specifically made subject to a performance standard or regulatory agency standard under any provision of the Contract Documents, Contractor shall furnish proof of conformance to the Architect. Proof of conformance shall be in the form of

.1 an affidavit from the manufacturer certifying that the item is in conformance with the applicable standard, or

.2 an affidavit from a testing laboratory certifying that the product has been tested within the past year and is in conformance with the applicable standard, or

.3 such further reasonable proof as is required by the Architect.

§ 3.5.7 The warranties of Contractor provided in Sections 3.5.2 and 3.5.3 shall in no way limit or abridge the warranties of the suppliers of equipment and systems which are to comprise a portion of the Work and all of such warranties shall be in form and substance as required by the Contract Documents. Contractor shall take no action or fail to act in any way which results in the termination or expiration of such third party warranties or which otherwise results in prejudice to the rights of Owner under such warranties. Contractor agrees to provide all notices required for the effectiveness of such warranties and shall include provisions in the contracts with the providers and manufacturers of such systems and equipment whereby Owner shall have a direct right, but not a duty, of enforcement of such warranty obligations.

§ 3.5.8 Contractor and Owner acknowledge that the Project may involve construction work on more than one school building for the Owner. Each building, or approved phase of each building, shall have its own, separate, and independent date of substantial completion or final completion. Contractor shall maintain a complete and accurate schedule of the dates of substantial completion, dates upon which the one-year warranty on each phase or building, which is substantially complete, will expire, and dates of final completion. If Owner, Architect or Program Manager discovers during the warranty period, deficiencies not previously reported, Contractor shall accompany the Owner, Architect and Program Manager on an inspection of such deficiencies and Contractor shall be responsible for correcting any such deficiencies not caused by the Owner or the use of the building. For extended warranties required by various sections, i.e. roofing, compressors, mechanical equipment, Owner will notify the Contractor of deficiencies and Contractor shall start remedying these defects within fifteen (15) days of initial notification from Owner. Contractor shall prosecute the work without interruption until accepted by the Owner and the Architect, even though such prosecution should extend beyond the limit of the warranty period

§ 3.6 Taxes

The Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

.1 The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.

.2 The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.

.3 Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.

.4 SWPPP

.5 The Contractor shall include in his base Proposal the permit fee required by Harris County. The Owner will be responsible for fees payable to the TDLR, any MUD and the Third-party plan reviewer.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for,

performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.7.6 The Contractor shall comply with the provisions of Section 22.0834 of the Texas Education Code and Section 153.1117 of the Texas Administrative Code. The form of certification by the Contractor shall be supplied by the Owner, and must be supplemented by the Contractor as required by law, or as requested by the Owner.

§ 3.7.7 The Contractor shall be responsible for timely notification to and coordination with all utility companies regarding the provision of or revising of services to the Project. The Contractor shall inform the Architect and Program Manager at once when the Owner's participation is required. Connections for temporary and permanent utilities and payment for temporary utilities services required for the Work, whether the Work is new construction or renovation of an existing facility, are the responsibility of the Contractor unless otherwise agreed. If the Work is new construction, payment for permanent utility services shall be the responsibility of the Contractor until Substantial Completion.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct and approve in writing. All unused allowance amounts shall be credited back to Owner. No markup shall be allowed for the Contractor on any expenditures from Allowances or Contingency funds included in the Contract Sum.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendent or project manager shall be binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed. In the event a substitution of superintendent is necessary, the Contractor shall reimburse the Owner, Architect and his Consultants (on a reasonable hourly basis) for additional costs incurred due to said substitution. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architect objects to any nominated superintendent. The superintendent must be at the construction site acting in his supervisory capacity at all times when construction is in progress. A separate full-time superintendent will be required for each school site.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path clearly defined. The schedule shall not exceed time limits current under the Contract Documents. For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals. Requirements for the submittal schedule are outlined in specification section 01 32 16, Construction Progress Schedules. If the Contractor fails to submit a submittal schedule or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in the Contract Sum or extension of the Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. All schedule updates shall address the subject of how the Contractor intends to address any critical path delays previously encountered. The schedule and all updates should address submittal activities as well as actual field construction activities. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor's schedule shall be prepared in a format which at a minimum graphically portrays (1) the beginning and duration for each phase of the Work described in those specification sections included in the Project Manual, (2) a critical path, meaning a limited sequence of critical activities, which establishes a linked sequence of each critical activity, a delay to any of which will cause a delay in completion of the Work, and (3) the float, indicating an activity or sequence which does not necessarily have to start or end on the scheduled date(s) to maintain the schedule. Approval of a Contractor's schedule does not constitute a commitment by the Owner to furnish any Owner-furnished information or material any earlier than Owner would otherwise be obligated to furnish that information or material under the Contract Documents. Failure of the Work to proceed in the sequence scheduled by Contractor shall not alone serve as the basis for a Claim for additional compensation or time. In the event there is interference with the Work, which is beyond its control, Contractor shall attempt to reschedule the Work in a manner that will hold resulting additional time and costs to a minimum. The construction schedule shall be in a detailed format satisfactory to the Owner, the Architect and Program Manager. If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner, Program Manager and the Architect and re-submitted for acceptance. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. The accepted construction schedule shall be updated to reflect actual conditions (sometimes referred to in these General Conditions as progress reports) as set forth in Section 3.10.1 or if requested by either the Owner or the Architect. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

§ 3.10.5 The Contractor's schedule may be considered when requested extensions of time are evaluated. The Owner's need for delivery of completed Work, or portions thereof, is largely controlled by the necessities of the school calendar and operations of school programs within that calendar. These needs are reflected in any schedule completion dates

and milestone dates set out in the Contract Documents. The Contractor shall perform the work in such a way as to not interfere with school operations, the importance of meeting milestones and completion dates. When it appears to Owner or Contractor that a Contract milestone or completion date cannot be met, Contractor will develop with the Owner, Program Manager and Architect a plan and a budget.

§ 3.10.6 The Owner shall have the right to reschedule the time of day for the performance of any part of the Work that may interfere with the operation of the Owner's premises or any tenants or invitees thereof. The Contractor shall, upon the Owner's request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any rescheduling of performance of the Work under this Section 3.10.6 may be grounds for an extension of the Contract Time, if permitted under Section 8.3.1, and an equitable adjustment in the Contract Sum, if: 1) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents, and 2) such rescheduling is required for the convenience of the Owner and is no attributable to any act or omission of Contractor.

§ 3.11 Documents and Samples at the Site

§ 3.11.1 The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 In addition to any other requirement in the Contract Documents and prior to installation, Contractor is to furnish or cause subcontractor to furnish, for the Owner and Architect's written approval, a physical sample of each specified item, product, fixture or device which is visible by the general public and/or attached to an architecturally finished surface. Samples shall be suitably labeled, adequately protected and properly stored at the site. Samples which are approved and undamaged will be considered to be suitable for incorporation into the Work.

§ **3.11.1** The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

.1 Submittals shall be submitted at the earliest possible time in order to expedite delivery of critical or long lead time items. For more complex systems and equipment (such as structural steel; doors, windows and hardware; casework; mechanical, electrical, and plumbing systems and equipment; food service equipment; sound systems and the like), the Contractor shall schedule at least 30 days for the Architect or the Architect's Consultants' review and submittals shall be sequenced logically in accordance with the schedule, required fabrication and installation time.

.2 Where colors are to be selected by the Architect, the Contractor shall submit all product color samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four

weeks of the date of the Contract for Construction. Regarding critical delivery items, wherever feasible, the Architect will release color selections on critical materials as they are needed.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

.1 If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

.2 The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

(Paragraph deleted)

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been accepted by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's acceptance thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's acceptance of a resubmission shall not apply to such revisions.

§ 3.12.9.1 Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services,

certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least thirty (30) days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contact for construction.

§ 3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

§ 3.12.13 The Contractor shall provide MEP coordination drawings within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at ¼ inch per foot minimum scale and shall include invert elevations and sections required to meeting intended purpose. The Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

§ 3.13 Use of Site

§**3.13.1** The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. When the Work is to be performed at an existing school location, Contractor shall schedule and perform the Work in a manner that does not compromise the safety to school students, faculty and staff, and does not unreasonably disrupt or interfere with the continuing normal routine of the school. If a School Operations Parameters Statement is a part of the Contract Documents, Contractor will comply with its terms, at no increase in price.

§ 3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction material and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

§ 3.13.3 The Contractor and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

§ 3.13.4 Contractor shall ensure that the Work, at all times, is performed in a manner that affords the Owner reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of: 1) any area and buildings adjacent to the site or the Work or 2) the building in the event of partial occupancy.

§ 3.13.5 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrance and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site; and make the Work ready in all respects for immediate and full use by the Owner.

§ 3.15.4 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor or deducted from the final payment to Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Program Manager, their designated representative, and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or

manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.

FOR ALL CLAIMS NOT ADDRESSED IN THE ABOVE PARAGRAPH, CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES AND (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, OF ANY NATURE WHATSOEVER ARISING OUT OF OR RELATED TO THIS AGREEMENT OR THE WORK TO BE PERFORMED UNDER THIS AGREEMENT, BUT ONLY TO THE EXTENT OF THE NEGLIGENCE OR OTHER FAULT OF THE CONTRACTOR, ITS AGENTS, REPRESENTATIVES, EMPLOYEES OR SUBCONTRACTORS OF ANY TIER.

§ 3.18.2 It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall **not** be obligated under Subparagraph 3.18 to indemnify or hold harmless Program Manager, Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

.1 defects in plans, designs or specifications prepared, approved or used by the Architect; or

.2 negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:

.1 personal injury or death;

.2 property injury; or

.3 any other expense that arises from personal injury, death or property injury.

§ 3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

§ 3.19 Record Drawings

§ 3.19.1 Refer Owner's Closeout Procedures

§ 3.20 Prevailing Wage Rates

§ 3.20.1 As required by Chapter 2258 of the Texas Government Code Title 10 Prevailing Wage Rate, no employee used in this construction may be paid less than the minimum prevailing wage rate in effect for the Owner.

§ 3.20.2 The Contractor and each Subcontractor and Sub-subcontractor shall pay to all laborers, workmen, and mechanics employed in execution of this Contract not less than rates set forth by law for each craft of type of workman or mechanic needed to execute this Contract.

§ 3.20.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates

identified.

§ 3.21 Antitrust Violations

§ 3.21.1 Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

§ 3.22 Third-Party Beneficiary

§ 3.22.1 No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Contract Documents by the responsibilities, activities or duties of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 Certain portions of the administration of the Contract will be performed by the Architect, others by the Program Manager. Both the Architect and the Program Manager will be treated as the Owner's representative to the extent set out in the Contract Documents. Neither the Architect nor the Program Manager shall have the authority to act on behalf of Owner unless such authority is expressly granted in the Contract Documents, nor shall such authority be implied from any act or representation of the Architect or Program Manager..

§ 4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the work is being performed in a manner indicating that the work, when fully completed, will be in accordance with the Contract documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1. Further:

.1 The Contractor expressly recognizes that the Architect does not owe him any duty to supervise or direct his work as to protect the Contractor from the consequences of his own acts or omissions.

.2 Upon reasonable request by the Owner, the Contractor shall accompany the Owner and Architect on an observation tour(s) of the building and shall note any defects and start remedying these defects within ten (10) days of the observation tour. Contractor shall prosecute the Work without interruption until accepted by the Owner and the Architect.

.3 Section 4.2.2, and the provisions of the Architect's Agreement with the Owner shall govern the number of site visits by the Architect. In this case, the Owner and Architect may agree in writing on an alternative site visit schedule that is appropriate for this particular project.

.4 If during the Architect's site visits the Architect observes any deviation from requirements of the Contract Documents, the Architect (or designee) shall report within three (3) business days to the Owner any such deviation. A copy of said report shall be sent to the

Contractor. Failure to observe or report any deviation shall not be a waiver to subsequently require correction of the same, similar or other deviations.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 All decisions on matters relating to aesthetic effect shall initially be made by the Architect; however, all such decisions are subject to the Owner's written approval.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor. Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed change**§ 5.2.5** The Contractor shall submit the list of proposed Subcontractors on AIA Document G805. The Contractor may obtain blank copies from the Architect.

§ 5.2.6 Contractor shall promptly notify the Owner, Architect and Program Manager of any material defaults by any subcontractor.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only to the extent permitted by law.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements The Owner reserves the right to perform other construction work, maintenance and repair work and school program operations at the site and near the site during the time period of the Work. Owner may perform other Work with separate Contractors or forces. Owner shall have access to the building on the site at all times..

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

(Paragraphs deleted)

§ 6.1.3 The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the other until subsequently revised.

§ 6.1.4 It shall be the responsibility of the Contractor to assist, review, coordinate, and schedule work performed by any of Owner's separate contractors including the hazardous materials abatement contractor. Contractor shall not be required to contract directly with the hazardous materials abatement contractor's and Owner's separate contractor's work, including required monitoring, testing and inspections by independent firms, with the Work under this Agreement. The Contractor shall be totally responsible for coordination between its Subcontractors and the hazardous materials abatement contractor and any other Owner's separate contractors. Contractor will cooperate with the Owner to allow site access and staging areas for hazardous materials abatement contractor and Owner's separate contractors and consultants. Contractor shall review Owner's contract with the hazardous materials abatement contractor and Owner's separate contractors and become familiar with the requirements and scope of services contain therein. Contractor shall continually review the work performed by the hazardous materials abatement contractor and Owner's separate contractors and immediately notify the Owner and Program Manager if at any time during the performance of Contractor's work, the hazardous materials abatement contractor or any of Owner's separate contractors fail, in any way, to provide sufficient, competent manpower or timely perform its services.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.1.1 No change in the Contract Sum and/or Contract Time will be allowed for a change in the Work unless, prior to performing the changed Work, the Contractor has provided the Owner in writing with a proposal for any change in price and/or change in Contract Time caused by the change in Work, and a Change Order is subsequently executed. A field directive or field order shall not be recognized as having any impact upon the Contract Sum or the Contract Time.

§ 7.1.1.2 Contingency Allowance Expenditure Authorization. A change in the work that does not require a change in Contract Sum or Contract Time may be paid from a designated Project Allowance. A Contingency Allowance Expenditure Authorization (CAEA) is a written order prepared by the Architect and signed by the Architect, Owner, Contractor and Program Manager directing a change in the Work.

§ 7.1.2 A Change Order shall be based on agreement among the Owner's Board of Trustees, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4. or the Owner's assessment of liquidated damages as allowed by the Contract Documents. In such event, the Change Order is deemed approved by Contractor, and Contractor's signature(s) are not required. A Construction Change Directive requires agreement by the Owner, or the Owner's representative, and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.
§ 7.1.2.1 Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the work or supply additional labor, services, or materials beyond that actually required by the terms of the Contract Documents, unless made pursuant to a written order from Owner authorizing Contractor to proceed with the change. No claim for an adjustment of the contract price will be valid unless so ordered.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders
§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum shall be determined in one or more of the ways listed below. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected:

.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Where additional Work is involved, any lump sum over the amount of $10,000.00 shall be broken down to represent the estimated cost of labor and materials plus mark-ups to cover overhead and profit.

.1 To compensate the Contractor, Subcontractor, or Sub-subcontractor actually performing a part of the Work for the combined cost of overhead and profit, the performing party shall be entitled to a single mark-up not to exceed 10% of the estimated cost of that part of the Work.

.2 To compensate (a) the Contractor for the combined cost of overhead and profit on Work performed by Subcontractors, or (b) Subcontractors for the combined cost of overhead and profit on Work performed by Sub-subcontractors, the Contractor or Subcontractor shall be entitled to a single mark-up not to exceed 5% of the subcontract amount.

.3 When a Sub-subcontractor performs the Work of a change, the maximum mark-up not to exceed 10% for combined overhead and profit shall be used only by the Sub-subcontractor. The Contractor and Subcontractor would each be entitled to a single mark-up not to exceed 5% of the cost to them for the Subcontractor and Sub-subcontractor, respectively.

.2 By Unit Prices stated in the Contract Documents or subsequently agreed upon. Additional mark-ups for overhead and profit will not be allowed in Unit Price work.

.3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee.

.4 Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.2.2 shall be limited to the costs established in Sections 7.3.7.1 through 7.3.7.5.

§ 7.2.3 Agreement on any Change Order shall constitute a final settlement of all claims by the Contractor directly or indirectly arising out of or relating to the change in the Work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs and impact costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3

(Paragraph deleted)

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the methods described in Section 7.2.2 or as provided in Section 7.3.4.

(Paragraph deleted)

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, directly related to the change and required by Contract Documents (unless the change is charged to an allowance already included in the Contract Sum, in which case additional mark-ups for these items will not be allowed; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits

covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

§ 7.5 Allowable Markups for Changes in the Work

§ 7.5.1 Unless otherwise directed, the procedure and markup of the costs for additional work shall be determined in the following manner:

.1 Upon Change Proposal request, the Contractor shall quote the cost for changes in the work showing separately, credits and additional costs broken down by headings used in the Schedule of Values. Further breakdown into units of labor and materials may be required if agreement on cost cannot be reached using the breakdown by headings. The final cost shall be the amount of the Total Contract Value Change shown on the Change Proposal signed by the Contractor and Owner. For general construction work, not subcontracted, the Contractor shall consider as costs the actual invoice amount for additional materials, the sales tax on additional materials when applicable, the wages paid for additional direct labor, plus the Contractor's usual markup of wages to cover additional labor related costs such as insurance, taxes and fringe benefits.

.2 On changes executed within the Owner's Contingency Allowance, Contractor shall have included costs for combined overhead and profit, to the extent permitted by the Contract Documents, and General Conditions costs, including the cost of superintendents, field office expense, temporary facilities and services, small hand tools, construction equipment not specifically provided for the change in hand, home office expense, bond and building insurance premiums, and managing the Subcontractor's work, in his Base Contract amount. Allowed overhead and profit fee on Owner's Contingency Allowance changes to be included in the total cost to the Owner shall be based as follows:

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's of Sub-subcontractor's own forces, ten percent (10%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.

§ 7.5.2 If any additional Work is authorized outside of or in excess of the Owner's Contingency Allowance, the combined overhead and profit for this work shall be based as follows:

.1 For the Contractor, for Work performed by the Contractor's own forces, a maximum total markup of ten percent (10%) of the actual cost on a lump sum project, or the Contractor's Construction Phase Fee on a Guaranteed Maximum Price Project.

.2 For Work performed by the Contractor's Subcontractor(s), five percent (5%) of the amount due the Subcontractor(s).

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

.4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.
.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

§ 7.5.3 In order to facilitate checking of quotations for extras or credits, all proposals, (except those so minor that their propriety can be seen by inspection), shall be accompanied by a complete and detailed itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

§ 7.5.4 Change orders, as they are accepted by the Owner, shall be entered under heading "Change Orders" in the next current Request for Payment.

§ 7.5.5 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5. All unused Contingency or Allowance amounts shall be credited back to Owner prior to final payment, along with any markups included in the Contract Sum or GMP on such unused amounts.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined. See further definition of "Day" in Section 1.9.10.§ 8.2 Progress and Completion

(Paragraph deleted)

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other unforeseeable causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. **No extensions of the Contract Time will be granted for inclement weather, except for Force Majeure events consisting of named storms or government declared emergencies resulting from extreme weather.**

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

§ 8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the

Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadline for substantial completion and Contractor's achievement of substantial completion.

§ 8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within sixty (60) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase, for each and every Calendar Day beyond the 60-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of sixty (60) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.1.1 The Owner is exempt from payment of Texas State Sales Tax on materials required for the Work. Therefore, to comply with the law, the Contract Sum shall be broken down into the amount of cost for labor and the amount of cost for materials. This breakdown shall be provided by the Contractor within ten (10) days of award of Contract.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect and Program Manager a schedule of values fairly allocating the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as reasonably required by the Architect and Program Manager, and updated for changes in the Work, the schedule of values shall be used only as a basis for reviewing the Contractor's Applications for Payment and is not to be taken as evidence of market or other value. The schedule shall not overvalue early job activities. Each item shall include a pro-rata portion of overhead and profit. The schedule shall follow the divisions of the Specifications so far as practicable and shall contain line items for equipment and system start up and testing.

§ 9.2.1 General Contractor's cost for Contractor's fee, bonds and insurance, General Conditions, etc., shall be listed as individual line items.

§ 9.2.2 Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

§ 9.2.3 Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items.

§ 9.2.4 On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicated line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

§ 9.2.5 Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

§ 9.2.6 The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

§ 9.2.7 The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balance requirements.

§ 9.3 Applications for Payment

§ 9.3.1 No later than 3 working days prior to the first Wednesday of each month, submit an itemized Application for Payment, supported by such data sustaining the Contractor's right to payment as the Owner or Architect may require, and reflecting retainage, as provided elsewhere in the Construction Documents. Information on the form shall be divided into the same last day of the month preceding, which shall also be the basis of payment or as agreed by the Owner, Contractor and Architect by verification at the site, prior to submittal.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

§ 9.3.1.2 Contractor agrees, for purposes of Texas Government Code 2251.042, receipt of the Certified Applications for Payment from the Architect shall not be construed as receipt of an invoice by the Owner. Contractor further agrees that Program Manager's receipt of the Certificate of Payment shall be construed as receipt of an invoice by the Owner, for purposes of Texas Government Code Section 2251.042

§ 9.3.2 Payments will be made on account of materials or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.3.4 The Contractor shall submit requests for payment in duplicate, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled

Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

§ 9.3.5 The Contractor shall submit the Fort Bend ISD Subcontractor Progress Assessment Form with each application for payment requesting payment be made for Work performed by a subcontractor that qualifies as a "small business" pursuant to FBISD Board Policy CV (Local). The Contractor shall also ensure that, once Contractor makes the applicable payment to the Small Business Subcontractor, the Subcontractor completes the Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form in its entirety and Contractor agrees to submit the completed copies to Owner with the next application for payment. The completed Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form must be received by the Owner before any further payment will be made to Contractor for any Work performed.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect and Program Manager to the Owner, based on the Architect's and Program Manager's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's and Program Manager's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, the results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect and Program Manager. The issuance of a Certificate for Payment will not be a representation that the Architect and Program Manager has (1) made exhaustive or continuous on-site inspections to check the quality of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from the Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to Payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1

The Architect or Program Manager may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect or Program Manager's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect or Program Manager is unable to certify payment in the amount of the Application, the Architect or Program Manager will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect or Program Manager cannot agree on a revised amount, the Architect or Program Manager will promptly issue a Certificate for Payment for the amount for which the Architect or Program Manager is able to make such representations to the Owner. The Architect or Program Manager may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the or part of a Certificate for Payment previously issued, to such extent necessary, in the Architect's or Program Manager's opinion, to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

1. Defective Work not remedied;
2. Third party claims field or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
3. Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
4. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
5. Damage to the Owner or another contractor;

6. Reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
7. Persistent failure to carry out the Work in accordance with the Contract Documents; or
8. Failure to submit a written plan indicating action by the Contractor to regain the time schedule for completion of Work within the Contract Time

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.5.5 If the work has not attained Substantial Completion by the date agreed upon and set forth in the Amendments, subject to extensions of time as described in the Contract Documents, Owner may, in sole discretion, direct Architect or Program Manager to withhold payment to Contractor to the extent necessary to reserve sufficient funds to complete the construction of the Project and to cover liquidated damages assessed against Contractor up to the time of the Application for Payment and to the time it is reasonably anticipated Substantial Completion will be achieved. The Owner shall not be deemed in default by reason of withholding payment as provided for in Sections 9.3.4, 9.4.3, 9.5.1, or this Section.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following Section which shall be inserted as Article 5, Progress Payments, in the Owner-Contractor Agreement, AIA Document A101, 2017 Edition.

.1 Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period ending the last day of the month as follows:

.2 Not later than twenty (20) working days following the first Wednesday of each month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing, for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner. Applications for Payment shall be submitted by the first Wednesday of the month.

.3 Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers

to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 Within seven (7) calendar days of receipt of payment from the Owner, the Contractor shall pay each subcontractor, out of the amount of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payment to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner. Owner is not obligated to monitor payments to Subcontractors or Sub-subcontractors, and nothing in this section shall create any right on the part of a Subcontractors or Sub-subcontractor against Owner, Architect or Program Manager. In compliance with Texas Government Code Section 2251.022, the Contractor shall, within ten (10) days following receipt of payment from the Owner, pay all bills for labor and materials performed and furnished by others in connection with the Work, and shall, if requested, provide the Owner with evidence of such payment. Contractor's failure to make payments within such time shall constitute a material breach of this Contract. Contractor shall include a provision in each of its Subcontractor's imposing the same payment obligations on its Subcontractors as are applicable to the Contractor hereunder, and if the Owner so requests, shall provide copies of such Subcontractor payments to the Owner. If the Contractor has failed to make payment promptly to the Contractor's Subcontractors or for materials or labor used in the Work for which the Owner has made payment to the Contractor, then the Owner shall be entitled to withhold payment to the Contractor in part or in whole to the extent necessary to protect the Owner.

§ 9.6.10 Contractor shall not withhold as retainage a greater percentage on Subcontractors or material men than the percentage Owner withheld as retainage from payments to the Contractor.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within ten days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within ten days after the date established in the Contract Documents, the amount certified by the Architect , then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents In order to initiate and facilitate the preparation of the Contractor's list of items to be completed or corrected (Punch List), the Architect and Program Manager, if requested by the Contractor, will inspect a few representative rooms with the Contractor's superintendent and the office project manager to assist the Contractor in the preparation of the Contractor's Punch List. The Contractor's superintendent shall participate in the preparation of the Contractor's Punch List that is submitted to the Architect and shall personally inspect each and every item himself before certifying to the Architect that listed items have been corrected. Should the Architect determine that the Contractor's Punch List lacks sufficient detail or requires extensive supplementation, the Punch List will be returned to the Contractor for revision and the inspection for determining the Date of Substantial Completion will be delayed until the Punch List submitted is a reasonable representation of the work to be completed. To further facilitate completion of the Work the Contractor's superintendent shall accompany the Architect and his consultants during their inspections and the preparation of their supplements to the Punch List and the superintendent shall record or otherwise take note of those supplementary items. The Architect will endeavor to furnish to the Contractor typed, hand-lettered, written or recorded supplements to the Punch List in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect shall not be cause for a claim for additional cost or extension of time as the Contractor's superintendent shall have been in attendance during the inspections of the Architect and his consultants and will have been expected to taken his own notes. Furthermore, a significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judges of what constitutes a significantly large number of items.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.6 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

.1 All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

.2 All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

The following items are a partial specific list of requirements, as applicable to the Project, that must be completed **prior** to established Substantial Completion of all portions of the work (Including the Substantial Completion of the

commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.
6. All required commissioning must be complete.
7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All room plaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
12. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.

§ 9.8.7 After the date of Substantial Completion of the Project, as evidenced by the Certificate of Substantial Completion, G704 current edition, the Contractor will be allowed a period of thirty (30) days (unless extended by mutual agreement or provision of the Contract) within which to correct all deficiencies attached to the Certificate of Substantial Completion. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the Contractor's Surety. In the report of deficiency, the Contractor and Surety will be informed that, should correction remain incomplete for fifteen (15) additional days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Section 14.2. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete the correction of deficiencies within thirty (30) days after the date of Substantial Completion (unless extended by mutual agreement or provision of the Contract) may be deducted from the funds remaining to be paid to the Contractor. Should corrective work following Substantial Completion require more than one reinspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from funds remaining unpaid to the Contractor.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect and the Program Manager finds the Work acceptable under the Contract Documents and the Contractor fully performed, the Architect and the Program Manager will promptly prepare, sign and issue a Certificate of Final Completion and a final Certificate for Payment certifying to the Owner that, on the basis of the Architect's and the Program Manager's on-site

visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance, including all retainages found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's and the Program Manager's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees. Prior to final payment, the Contractor shall meet all of the requirements of Owner's Closeout Procedures.**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

(Paragraph deleted)

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor thirty-one (31) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, and the Final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions have been satisfied.**§ 9.10.7** Contractor agrees that the Owner may place and install as much equipment and furnishings during the progress of the building as is possible before completion of the various parts of the Work, or may occupy portions of the Work before substantial completion of the entire Work, and further agrees that such placing and installing of equipment and furnishings or occupancy of portions of the Work shall not in any way evidence the substantial completion of the entire Work, or signify Owner's acceptance of the Work, nor does it affect claims for liquidated damages in case Substantial Completion is not achieved as required unless the failure to reach Substantial Completion is the result of the early move-in or occupancy. Owner will assume the responsibility for any damages to the Work caused by such occupancy.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract and shall conform to all provisions of the "Manual of Accident Prevention in Construction", published by the Associated General Contractor of America, Inc. latest edition and the Contractor further agrees to fully comply with all safety standards required by the Occupational Safety and Health Administration (:OSHA") 29 USC Section 651 et seq,. and all amendments thereto. However, the Contractor's duties herein shall not relieve any Subcontractor and any other person or entity, including any person or entity required to comply with all applicable federal, state and local laws, rules, regulations, and ordinances, form the obligation to provide for the safety of their employees, persons and property and their requirements to maintain a work environment free of recognized hazards.

§ 10.1.2 Contractor's employees, agents, Subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, shall not perform any service for Owner while under the influence of any amount of alcohol or any controlled substance, or use, posses, distribute, or sell alcoholic beverages while on Owner's premises. No person shall use, possess, distribute, or sell illicit or unprescribed controlled drugs or drug paraphernalia; misuse legitimate prescription drugs; or act in contravention of warnings on medications while performing the Work or on Owner's premises.

§ 10.1.3 Contractor has implemented it's own Safety Manual to assure a drug-free and alcohol-free workplace while on Owner's premises or performing the Work. Contractor will remove any of its employees, agents, subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such person, and at any time an accident occurs where drug or alcohol use could have been a contributing factor, Owner has the right to require Contractor to remove any person from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, the person so removed may only be considered for return to work after the Contractor certifies as a result of a for-cause test, conducted immediately following removal that said person was in compliance with this Contract. Contractor will not use any person to perform the Work who fails or refuses to take, or tests positive on, any alcohol or drug test.

§ 10.1.4 Contractor will comply with all applicable federal, state and local drug and alcohol-related laws and regulations (e.g., Department of Transportation regulations, Drug-Free Workplace Act). Owner has also banned the presence of all weapons on the Project site, whether or not the owner thereof has a permit for a concealed weapon, and the Contractor agrees that the Contractor's representative, employees, agents, and sub-contractors will abide by the same.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards, for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property

adjacent to the Project and improvements therein. Any damage to such property for improvements shall be promptly repaired by the Contractor. Contractor shall provide reasonable fall protection safeguards and provide approved fall protection safety equipment for use by all exposed Contractor employees.

§ 10.2.4 When use of storage of hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such under supervision of properly qualified personnel, and shall only conduct such activities after giving reasonable advance written notice of the presence or use of such materials, equipment or methods to Owner and Architect. The storage of explosives on Owner's property is prohibited. The use of explosives materials on Owner's property is prohibited unless expressly approved in advance by authorities having jurisdiction and in writing by Owner and Architect. When use or storage of hazardous materials or equipment or unusual construction methods are necessary, the Contractor shall give the Owner, Program Manager and the Architect reasonable advance notice of the presence or use of such materials, equipment, or methods.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect. Additionally, Contractor shall submit a Safety Plan for the Owner's approval prior to commencing the Work which meets or exceeds the minimum requirements set forth in the provisions of the FBISD Safety Plan. Unless otherwise specified in the Contract Documents, Contractor shall be responsible for initiating, maintaining, supervising, and enforcing all safety precautions and programs in connection with the Work. It shall be the duty and responsibility of the Contractor and all of its Subcontractors to be familiar and comply with all requirements of Public Law 91-596,29 U.S.C. § 651 et. Seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all the provisions of the Act. Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property to protect them from damage, injury or loss and shall erect and maintain all necessary safeguards for such safety and protection. However, the Contractor's duties shall not relieve any subcontractor(s) or any person or entity (e.g. a supplier) including any person or entity with liability relative to compliance with all applicable federal, state and local laws, rules, regulations, and ordinances which shall include the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

§ 10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

§ 10.2.11 The Contractor shall promptly report in writing to the Owner, Program Manager and Architect all accidents

arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statement of any witness. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Program Manager and the Architect.

§ 10.2.12 The Contractor shall be responsible for the protection and security of the Work until it receives written notification that the Substantial Completion of the Work has been accepted by the Owner.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Section 10.3.2.

§ 10.3.1.1 Owner and Contractor may enter into a separate agreement and/or Change Order for Contractor to remediate and/or render harmless the Hazardous Substance, but Contractor shall not be required to remediate and/or render harmless the Hazardous Substance absent such agreement. Contractor shall not be required to resume work in any area affected by the Hazardous Substance until such time as the Hazardous Substance has been remediated and/or rendered harmless.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

(Paragraphs deleted)

§ 10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

(Paragraphs deleted)

§ 11.2 § 11.2.1 § 11.2.2 § 11.2.3 § 11.2.4 § 11.2.5 § 11.2.6 intentionally deleted.

Please refer to Exhibit A to AIA Document A133-2009, Insurance and Bond Requirements.

(Paragraphs deleted)

§ 11.3 The Owner requires that the following insurance requirements be satisfied:

.1 No Work shall be commenced until all insurance requirements set forth in this Agreement have been approved by the Owner in writing.

.2 All insurance policies and certificates required hereunder shall be in form and content satisfactory to the Owner.

.3 The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and endorsements required by this Agreement prior to execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written notice shall be given to the Owner in the event of cancellation, material change, or non-renewal.

.5 Insurance shall be underwritten by a company licensed to do business in Texas, satisfactory to Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one (1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent of the Owner.

.8 All insurance except Professional Liability must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the Owner as Additional Insures, and (b) showing waivers of subrogation in favor of the Owner.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum if the formal contract is in excess of Twenty Five Thousand Dollars ($25,000.00).

§ 11.4.2 The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

§ 11.4.3 The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds land as Acceptable Reinsuring companies.

§ 11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

§ 11.4.5 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety.

The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no responsibility because of any representation by any agent or employee.

§ 11.5 Worker's Compensation Insurance

§ 11.5.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities

§ 11.5.2 Definitions:

.1 Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing service as on a project, for the duration of the project.

.2 Duration of the project –includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

§ 11.5.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

§ 11.5.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

§ 11.5.5 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

§ 11.5.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

.1 A certificate of coverage, prior to that person beginning work on the projects so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project, and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

§ 11.5.7 The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

(Paragraphs deleted)

§ 11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

§ 11.5.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Worker's Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack coverage.

§ 11.5.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meet the statutory requirements of Texas Labor code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project.

.2 Provide the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.

.3 Provide the Contractor, prior to the end of the coverage period shown on the current certificate ends during the duration of the project.

.4 Obtain from each other person with whom it contracts, and provides to the Contractor:

.1 A certificate of coverage, prior to the other person beginning work on the project, and

.2 A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

.5 Retain all required certificates of coverage on file for the duration of the project and for one year thereafter.

.6 Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and

.7 Contractually require each person with whom it contracts, to perform as required by these subsections (1)-(7), with the certificates of coverage to be provided to the person for whom they are providing services.

§ 11.5.11 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other actions.

§ 11.5.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. The Owner may make emergency repairs to the Work or take such other measures necessary under the circumstance, if the Contractor does not promptly respond to a Notice of Defect or nonconforming Work.

Contractor shall be responsible to Owner for this cost if the reason for the repairs is attributable to the Contractor. If payments then or thereafter due to the Contractor are not sufficient to cover such costs, then the Contractor shall pay the difference to the Owner on demand.

§ 12.2.1.1 In the event of failure of a specified project, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

§ 12.2.1.2 Refer to 01 77 00, Closeout Procedures in Division One for further terms regarding warranties which will be required prior to final payment.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

§ 12.3.1 If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

§ 12.3.2 The Owner's use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner's acceptance is provided to the Contractor in writing.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 Equal Opportunity

§ 13.7.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 13.8 Criminal Background Checks

The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Fort Bend ISD Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

§ 13.9 Required Certifications

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor hereby certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

Contractor verifies that: (1) it does not, and will not for the duration of the contract, boycott energy companies or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

Contractor verifies that: (1) it does not, and will not for the duration of the contract, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.2.5 The Contractor hereby assigns the Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et. Seq. (1973).

§ 14.2.6 If a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, the Surety shall promptly remedy the default by completing the Contract in accordance with its terms and conditions, or by obtaining a bid or bids in accordance with its terms and conditions. At Owner's election, upon determination by the Owner and the Surety of the lowest responsible bidder, the Surety will complete the Work or will arrange for a Contract between such bidder and the Owner, and make available as Work progresses sufficient funds to pay the cost of completion less the balance of the Contract Sum, but not exceeding the Penal Sum of the bond and other costs and damages for which the Surety may be liable under the bond. The phrase 'balance of the Contract Sum' as used herein shall mean the total amount payable by the Owner to the Contractor under the Contract and amendments thereto less the amount previously paid by the Owner to the Contractor.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In the case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within ninety (90) days after occurrence of the event giving rise to such Claim or within ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Contractor agrees that this is a reasonable Notice requirement. Any Claim or portion of a Claim that has not been made the specific subject of a Notice strictly in accordance with the requirements of this section is waived.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 No extensions of the Contract Time will be granted for inclement weather, except as stated in Section 8.3.1.

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(Paragraphs deleted)

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 11.3.9 and 11.3.10, or claims alleging an error or omission by the Architect, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties, but subject to mediation, if both parties so agree, and subject to legal or equitable proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

(Paragraphs deleted)

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

(Paragraph deleted)

§ 15.2.9 The prevailing party in any judicial proceeding arising from the Contract Documents shall recover its reasonable and necessary attorneys' fees.

§ 15.3 Mediation

(Paragraph deleted)

§ 15.3.2 The parties may mutually agree to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing unless stayed for a longer period of agreement of the parties or court order.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

(Paragraphs deleted)

ARTICLE 16 Contractor Accounts, Records, and Inspection

Contractor shall at all times maintain job records, including, but not limited to, invoices, payment records, payroll records, daily reports, logs, diaries, and job meeting minutes, applicable to the project. Contractor shall make such reports and records available to inspection by the Owner, Architect, or their respective agents, within five (5) working days of request by Owner, Architect, or the respective agents. Job Records must be retained by Contractor for at least seven (7) years after the date of Final Completion of the Project. Furthermore, the Contractor shall promptly provide copies, including by electronic means, of all documents that may be required by the State Public Information Act.

ARTICLE 17 Business Ethics

§ 17.1 During the course of pursuing contracts, and the course of Contract performance, Contractor and its Subcontractors and vendors will maintain business ethics standards aimed at avoiding real or apparent impropriety or conflicts of interest. No substantial gifts, entertainment, payments, loans or other considerations beyond that which would be collectively categorized as incidental shall be made to any personnel of the Owner, its Program Managers, or its Architects, or to family members of any of them. At any time Contractor believes there may have been a violation of this obligation, Contractor shall notify Owner of the possible violation. Owner is entitled to request a representation letter from Contractor, its Subcontractors or vendors at any time to disclose all things of value passing from Contractor, its Subcontractors or vendors to Owner's personnel, its Program Managers and its Architects.

§ 17.2 The Owner may, by written notice to the Contractor, cancel the Contract for Construction without liability to the Contractor if it is determined by the Owner that gratuities, in the form of entertainment, gifts, or anything of monetary value, were offered or given by the Contractor, or any agent, or representative of the Contractor, to any officer or employee of the Fort Bend Independent School District with a view toward securing a contract or securing favorable treatment with respect to the awarding, amending, or making of any determinations with the respect to the performing of such a contract. In the event the Construction Agreement is cancelled by the Owner pursuant to this provision, Owner shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by the Contractor in providing such gratuities.

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

ADDITIONS AND DELETIONS:
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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

Additions and Deletions Report for

AIA® Document A201® – 2017

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PAGE 1

(Name, legal status and address)

Fort Bend Independent School District
16431 Lexington Boulevard
Sugar Land, Texas 77479

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The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Performance Bond, Labor and Material Payment Bond, Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the ~~Agreement,~~ Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change ~~Directive,~~ Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to ~~bid, Instructions to Bidders,~~ propose, instructions to Proposers, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's ~~bid or proposal,~~ Proposal or portions of Addenda relating to ~~bidding or proposal requirements.~~proposal requirements).

...

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents. Nothing in these Conditions shall be interpreted as imposing on either the Owner or the Architect, or their respective agents, employees, officers, directors or consultants, any duty, obligation or authority with respect to any items that are not intended to be incorporated into the completed Project, or that do not comprise the Work, including, without limitation, shoring, scaffolding, hoists, weatherproofing, or any temporary facility or activity, since these are the sole responsibility of the Contractor.

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§ 1.2.1.2 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as "1".

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.

.2 The Agreement. (AIA Document A101-2017)

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.3 The General Conditions of the Contract for Construction

.4 Addenda, with those of later date having precedence over those of earlier date

.5 Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitating avoiding increase in the Contract cost. If an item is shown one place in the Drawings, but no another, or called for in a schedule or the specifications but not shown on the Drawings, or shown on the Drawings but not in a schedule, it is to be included. Existing conditions take precedence over Drawings and Specifications for dimensions.

§ 1.2.1.3 Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

...

§ 1.2.4 In the case of inconsistency within or between the Drawings and Specifications discovered prior to Proposal Submission Time but too late to be clarified by an Addendum, the better quality or greater quantity of Work shall be included in the Proposal. Clarification of any inconsistency will be accomplished with the Contractor after award of Contract and, if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

§ 1.2.5 Product and Reference Standards. When specific products, systems or items of equipment are referred to in the Contract Documents, any ancillary devices which the Contractor knows, or in accordance with the standard of care for a Contractor should have known, is necessary for proper functioning shall also be provided. When standards, codes, manufacturer's instructions and guarantees are required and no edition is specified by the Contract Documents, the current edition at the time of Contract execution shall apply whether or not the proper edition was set out in the Contract Documents. References to standards, codes, manufacturer's instructions and guarantees shall apply in full, except:

.1 They do not supersede more stringent standards set out in the Contract Documents, and

.2 any exclusions or waivers that are inconsistent with the Contract Documents do not apply.

§ 1.2.6 Relations of Specifications and Drawings. General Requirements in the Specifications govern the execution of all Work. Summary paragraphs present a brief indication of the Work, but do not limit the Work as later detailed. Should the Drawings and Specifications have internal inconsistencies, then the Contractor shall base the bids and construction on the most expensive combination of quality and quantity of work indicated. For purposes of construction, the Architect shall determine the appropriate Work, after the Contractor brings the inconsistency to the Architect's attention. Failure to report an inconsistency shall be evidence that Contractor has elected to proceed in the more expensive manner.

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§ 1.6.1 ~~Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and~~ Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served ~~if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.~~on the next business day.

~~**§ 1.6.2** Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.~~

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§1.9 Miscellaneous Other Definitions

§1.9.1 Addenda, Addendum. Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

§1.9.2 Alternate Proposal(s). A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

§1.9.3 Approved, Approved Equivalent, Approved Equal, or Equal. The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.4.2, Substitution of Products and Systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of proposals is described in the Instructions to Bidders.

§1.9.4 Base Proposal. The Contractor's proposal for the Work, not including any Alternates.

§1.9.5 Contract Time. The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments as enumerated in the Contract Documents.

§1.9.6 Date of Agreement. The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

§1.9.7 Date of Commencement of the Work. The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

§1.9.8 Date of Final Completion. The end of construction. See AIA Document A201, Section 9.10.

§1.9.9 Day. The following days are referenced in the documents:

.1 **Calendar Days**: The Contract Time is established in Calendar Days and extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.2 **Holidays:** The days officially recognized by the construction industry in this area as a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after and Christmas Day.

.3 **Regular Work Days:** All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).

.4 **No extensions of the Contract Time will be granted due to inclement weather except as stated in Section 8.3.1.**

§ 1.9.10 Final Completion. Achieved after the Work has been completed by the Contractor, the final inspection has been performed by the Architect and the Owner, the Contract Closeout process has been completed, and the final Certificate for Payment has been issued by the Architect to the Owner. See Sections 1.1.14 and 9.10 and Specification sections regarding Contract Close Out.

§1.9.11 Notice to Proceed. A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

§ 1.9.12 The Project Manual. A volume assembled for the Work which may include the Proposal requirements, sample forms, Conditions of the Contract, Drawings and Specifications.

§ 1. 9.13 Proposal. A complete and properly signed proposal to do the Work for the sums stipulated therein, submitted

on the prescribed forms in accordance with the Proposal Documents.

§ 1.9.14 Proposal Documents. All documents and bound into or referenced in the Project Manual, the Drawings, and Addenda related thereto. The Project Manual contains the Proposal requirements, Contract and other forms, Conditions of the Contract, the Specifications, and a list of Drawings and Schedules, some of which are bound into the Project Manual (other Drawings and Specifications are bound separately).

§ 1.9.15 Proposer. A person or entity who submits a Proposal.

§1.9.16 Provide. Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

§1.9.17 Punch List. A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

§ 1.9.18 SMALL BUSINESS ENTERPRISE PROGRAM ("SBEP"). Owner has adopted the SBEP to provide increased business opportunities for locally certified small businesses to competitively participate in contracting and procurement within FBISD. *See* FBISD Board Policy CV(Local).

§ 1.9.19 SUB-PROPOSER. A person or entity who submits a Proposal to a Proposer for materials, equipment or labor for a portion of the Work.

§1.9.20 Unit Prices. A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark up by the Contractor or his subcontractors."

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§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. ~~The Owner shall designate in writing a representative who shall have express~~ All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the ~~Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority.~~ Board's approval under current policy of the Board of Trustees for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

~~**§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.**~~

§ 2.1.2 The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to enter into a contract, to approve a Change Order requiring an increase in the Contract Sum, or agree to an extension to the contractual Completion Date, unless this authority is lawfully delegated. Neither Architect nor Contractor may reply upon the direction of any employee of Owner or Program Manager who has not been designated in writing by the Superintendent of Schools or Board of Trustees of Owner; Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

§ 2.1.3 The presence of the Owner, Program Manager or Architect at the Work site does not imply acceptance or approval of the Work.

§ 2.1.4 The Owner, being a public body under the laws of the State of Texas, must have funds in the full amount of the Contract on hand prior to award and execution of the Contract. Furthermore, no Contract exists between the Owner and the Contractor until the formation of the Contract is approved by a majority of the Board of Trustees of the Owner in open session at a duly held Board meeting, and the contract is signed by an authorized Owner's representative.

§ 2.1.5 At any time prior to the Owner's receipt of the executed Agreement with the required bonds and insurance, the Owner may, at its sole option and without cause, reject the offer described in this Agreement by delivering to the Contractor a written notice stating so. Such notice shall be signed by the Owner's Director of Purchasing or designee, and shall be effective on receipt by the Contractor. The rejection of the offer described in this Agreement, shall cause no obligation or duty to the Owner save return of bid or proposal security, if any, if rejection is without cause. This section does not pertain to rejection for cause by the Owner, or for the Contractor's failure to provide require bonds or insurance.

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. ~~The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.~~

~~**§ 2.2.2** Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

~~**§ 2.2.3** After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.~~

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§ 2.3.6 ~~Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.~~The Contractor shall pay the cost of reproduction, postage, and handling of all sets of Drawings and Specifications necessary for the Contractor to execute the Work. If the Contractor requests in writing that the Architect and his Consultants update the original Drawings and Specifications to incorporate Addendum items, or Modifications, the Architect and his Consultants will do so at their expense. However, the Contractor shall pay the cost of reproduction, postage and handling of all sets of Drawings and Specifications necessary for the Contractor to execute the Work.

...

If the Contractor defaults or neglects to carry out the ~~Work~~ work in accordance with the Contract Documents and ~~fails within a ten-day period~~ fails, after receipt of written notice from the ~~Owner~~ Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such ~~default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable~~ deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the ~~Architect's additional services made necessary by such default, neglect, or failure. If current and future payments~~ Architect, Program Manager and other consultants' additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the ~~Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.~~Owner within thirty (30) days of receipt of written notice from the Owner therefor.

§ 2.5.1 After the Work is complete the Owner may make emergency repairs to the Work if necessary to prevent further damage, or if the Contractor does not promptly respond to a notice of a condition requiring repairs. Contractor shall be responsible to Owner for this cost if the reason for the repairs is defects in Contractor's Work. If payments then or thereafter due the Contractor are not sufficient to cover such costs, the Contractor shall pay the difference to the Owner

§ 2.7 Owner's Right to Occupy the Project

§ 2.7.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not yet have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents. If the Contractor determines that said occupancy may cause a delay to the completion of the project, he shall notify the Owner in writing immediately.

§ 2.7.2 Refer to Article 11 Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

§ 2.7.3 If Contractor has not completed the obligations of the Contract Documents by the dates established by subsequent Amendments to the Agreement Between Owner and Construction Manager, the Owner shall have the right to occupy or use the entire project.

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§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect or Program Manager in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

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§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or ~~Architect~~ architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public ~~authorities.~~authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

§ 3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation or initiating a Request for Information (RFI). The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work complies with the Contract Documents. The Contractor shall arrange meetings for the Architect, prior to commencement of the Work, with all major subcontractors, to allow the subcontractor to demonstrate his understanding of the documents to the Architect and to allow the subcontractor to ask for any interpretation he may require. Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 3.2.6 If, in the opinion of the Architect and the Program Manager, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to

expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

§ 3.2.7 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes, including substitutions of materials, shall be accomplished by appropriate Modification. If the Contractor fails to perform the obligations of Section 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

§ 3.2.8 Prior to performing any Work, and only if applicable, Contractor shall locate all utility lines as shown and located on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, electrical lines, including, but not limited to, all buried pipelines and buried telephone cables, and shall perform any Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines. In addition, Contractor shall independently determine the location of same. Contractor shall be responsible for any damage done to such utility lines, cables, pipes and pipelines during its construction work, and shall be responsible for any loss, damage, or extra expense resulting from such damage. The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including

.1 the location, condition, layout and nature of the Project site and surrounding areas;
.2 generally prevailing climatic conditions;
.3 anticipated labor supply and costs;
.4 availability and cost of materials, tools and equipment; and
.5 other similar issues.

§ 3.2.9 Contractor shall be responsible for any damage done to such lines, cables, pipes and pipelines during its construction work resulting from its negligent conduct

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§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines ~~that~~ such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely ~~notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.~~ written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors. . It is understood and agreed that the relationship of Contractor to Owner shall be that of an independent Contractor. Nothing contained herein or inferable here from shall be deemed or construed to (1) make Contractor the agent, servant or employee of the Owner, or (2) to create any partnership, joint venture, or other association between Owner and Contractor. Any direction or instruction by Owner or any of its authorized representatives in respect to the Work shall relate to the results the Owner desires to obtain from the Work, and shall in no way affect Contractor's independent Contractor status described herein. As part of that responsibility, Contractor shall enforce the Owner's alcohol-free, drug-free, tobacco-free, harassment-free and weapon-free policies and zones, which will require compliance with those policies and zones by Contractors'

employees, subcontractors, and all other persons carrying out the Contract. Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, while on Owner's property, to refrain from committing any criminal conduct, using tobacco products, possessing or drinking alcoholic beverages, possessing or using illegal drugs or any controlled substance, carrying weapons, speaking profane and/or offensive language, or engaging in any inappropriate interactions of any nature whatsoever with students, and teachers, staff and visitors, including talking, touching, staring or otherwise contributing to a hostile or offensive environment for Owner's students and staff. All areas of campus, other than the defined construction area, shall be off limits to Contractor's forces, unless their work assignment specifies otherwise. Contractor shall also require adequate and appropriate dress and identification of Contractor's employees, subcontractors, and all other persons carrying out the Work. The Contractor shall further ensure that no on-site fraternization shall occur between personnel under the Contractor's and Subcontractor's direct or indirect supervision and Owner's students or employees and the general public. Failure of an individual to adhere to these standards of conduct shall result in the immediate termination of the employment of the offending employee from all construction on any of Owner's property and immediate removal from the site.

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§ 3.3.4 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

§ 3.3.5 Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring procedures, in accordance with Texas Government Code, Section 2166.303 and Texas Health and Safety Code, Subchapter C, Sections 756.021, et seq. On trench excavations in excess of 5 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

§ 3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site, the work shall be supervised by a qualified employee of the Contractor.

§ 3.3.7 The Contractor shall review Subcontractor safety programs, procedures, and precautions in connection with performance of the Work. However, the Contractor's duties shall not relieve any Subcontractor(s) or any other person or entity (e.g., a supplier), including any person or entity with whom the Contractor does not have a contractual relationship, of their responsibility or liability relative to compliance with all applicable federal, state, and local laws, rules, regulations, and ordinances which shall include the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards. The foregoing notwithstanding, the requirements of this Section are not intended to impose upon the Contractor any additional obligations that the Contractor would not have under any applicable state or federal laws, including, but not limited to, any rules, regulations, or statutes pertaining to the Occupational Safety and Health Administration

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§ 3.4.2 ~~Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.~~The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

.1 If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary

by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.

.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

.3 Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

.4 By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

.5 Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

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.1 State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

.2 State law prohibits weapons or firearms on school property.

.3 There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

.4 No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

.5 Background checks

Contractor must give advance notice to the Owner if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. The Owner may terminate this Agreement pursuant to Article 14 Termination if the Owner determines that the person or business entity failed to give notice as required by this section or misrepresented the conduct resulting in the conviction. This section requiring advance notice does not apply to a publicly held corporation. THE CONTRACTOR RELASES, INDEMNIFIES AND HOLDS HARMLESS THE OWNER FOR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH OWNER'S DRUG-FREE, ALCOHOL-FREE, WEAPON-FREE, HARASSMENT-FREE, AND TOBACCO-FREE ZONES OR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH CRIMINAL LAW.

§ 3.4.4 The Contractor shall disclose the existence and extent of any financial interests, whether director indirect, such Contractor may have in any Subcontractor or material supplier which the Contractor may propose for this Project.

...

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and ~~new~~ new, unless the Contract Documents require or permit otherwise. The ~~Contractor~~ contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of ~~the~~ Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect ~~caused~~ cause by abuse, ~~alterations~~ material alteration to the Work not executed by the Contractor, ~~improper or insufficient maintenance, improper operation,~~ insufficient maintenance or maintenance not in compliance with written instructions therefor, operation not in compliance with written instructions therefor, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall

furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranties set out in this section are not exclusive of any other warranties or guarantees set out in other places in the Contract Documents or implied under applicable law.

...

§ 3.5.3 In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

§ 3.5.4 The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods) extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

§ 3.5.5 The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

§ 3.5.6 Contractor shall certify that the Project has been constructed in conformance with the Architect's or Engineer's plan, specifications, and Contract Documents, as modified from time to time pursuant to the terms of the Contract Documents. Contractor shall fully complete a "Certification of Project Completion" as required by 19 Texas Administrative Code Section 61.1036(c) (3) (F). The Contractor shall deliver to the Owner its written guarantee, in the form attached to this contract as Exhibit "F", guaranteeing all of the work under the contract to be free from faulty materials in every particular, and free from improper workmanship, and against injury except from proper and usual wear and tear; and agreeing to replace or re-execute without cost to the Owner such work as may be found to be improper, imperfect or of unsatisfactory material and/or workmanship, without cost to the Owner, and to make good all damage caused to other work or materials, or to the Owner's property, real and personal, due to such improper, imperfect or faulty material and/or workmanship, and/or due to the required replacement or re-execution. Such warranty periods shall be maintained notwithstanding that certain systems may be activated prior to Substantial Completion as required for the satisfactory completion of the project. This guarantee shall be made to cover a period of one (1) year from the date of Substantial Completion as certified by the Architect under this Contract. This guarantee must be furnished to the Owner and approved by it before acceptance and final payment is made.

Upon written notice from the Owner, the Contractor shall promptly remedy defects as covered by his guarantee. If Contractor does not respond to Owner's written notice, either by beginning corrective work or notifying the Owner in writing stating when work will begin, within ten (10) days of receipt, the Owner may take measures to correct the work himself and Contractor will be obligated to reimburse Owner's costs. If notice of defects covered by warranty is given in writing to the Contractor on a timely basis, the obligation to provide the warranty work may extend beyond the one year warranty period until the warranty defect is remedied and accepted by the Owner. The Contractor shall provide bond coverage to extend for the one (1) year period of the guarantee to insure performance under the terms of his obligation. The provisions of this section shall be in addition to, and not in lieu of, any other rights and remedies available to the Owner.

§ 3.5.6.1 All required warranties on equipment, machinery, materials, or components shall be submitted to the Architect and Program Manager on the manufacturer's or supplier's approved forms at the time of Substantial Completion.

§ 3.5.6.2 When deemed necessary by the Owner and prior to installation of any item specifically made subject to a performance standard or regulatory agency standard under any provision of the Contract Documents, Contractor shall furnish proof of conformance to the Architect. Proof of conformance shall be in the form of

.1 an affidavit from the manufacturer certifying that the item is in conformance with the applicable standard, or

.2 an affidavit from a testing laboratory certifying that the product has been tested within the past year and is in conformance with the applicable standard, or

.3 such further reasonable proof as is required by the Architect.

§ 3.5.7 The warranties of Contractor provided in Sections 3.5.2 and 3.5.3 shall in no way limit or abridge the warranties of the suppliers of equipment and systems which are to comprise a portion of the Work and all of such warranties shall be in form and substance as required by the Contract Documents. Contractor shall take no action or fail to act in any way which results in the termination or expiration of such third party warranties or which otherwise results in prejudice to the rights of Owner under such warranties. Contractor agrees to provide all notices required for the effectiveness of such warranties and shall include provisions in the contracts with the providers and manufacturers of such systems and equipment whereby Owner shall have a direct right, but not a duty, of enforcement of such warranty obligations.

§ 3.5.8 Contractor and Owner acknowledge that the Project may involve construction work on more than one school building for the Owner. Each building, or approved phase of each building, shall have its own, separate, and independent date of substantial completion or final completion. Contractor shall maintain a complete and accurate schedule of the dates of substantial completion, dates upon which the one-year warranty on each phase or building, which is substantially complete, will expire, and dates of final completion. If Owner, Architect or Program Manager discovers during the warranty period, deficiencies not previously reported, Contractor shall accompany the Owner, Architect and Program Manager on an inspection of such deficiencies and Contractor shall be responsible for correcting any such deficiencies not caused by the Owner or the use of the building. For extended warranties required by various sections, i.e. roofing, compressors, mechanical equipment, Owner will notify the Contractor of deficiencies and Contractor shall start remedying these defects within fifteen (15) days of initial notification from Owner. Contractor shall prosecute the work without interruption until accepted by the Owner and the Architect, even though such prosecution should extend beyond the limit of the warranty period

The ~~Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.~~Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

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.1 The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.

.2 The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.

.3 Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.

.4 SWPPP

.5 The Contractor shall include in his base Proposal the permit fee required by Harris County. The Owner will be responsible for fees payable to the TDLR, any MUD and the Third-party plan reviewer.

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§ 3.7.6 The Contractor shall comply with the provisions of Section 22.0834 of the Texas Education Code and Section 153.1117 of the Texas Administrative Code. The form of certification by the Contractor shall be supplied by the Owner, and must be supplemented by the Contractor as required by law, or as requested by the Owner.

§ 3.7.7 The Contractor shall be responsible for timely notification to and coordination with all utility companies regarding the provision of or revising of services to the Project. The Contractor shall inform the Architect and Program Manager at once when the Owner's participation is required. Connections for temporary and permanent utilities and payment for temporary utilities services required for the Work, whether the Work is new construction or renovation of an existing facility, are the responsibility of the Contractor unless otherwise agreed. If the Work is new construction, payment for permanent utility services shall be the responsibility of the Contractor until Substantial Completion.

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract ~~Documents.~~ documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may ~~direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.~~direct and approve in writing. All unused allowance amounts shall be credited back to Owner. No markup shall be allowed for the Contractor on any expenditures from Allowances or Contingency funds included in the Contract Sum.

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§ 3.9.1 The Contractor shall employ a competent ~~superintendent~~ superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the ~~Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as~~ Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendent or project manager shall be binding as if given to the Contractor.

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§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed. In the event a substitution of superintendent is necessary, the Contractor shall reimburse the Owner, Architect and his Consultants (on a reasonable hourly basis) for additional costs incurred due to said substitution. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architect objects to any nominated superintendent. The superintendent must be at the construction site acting in his supervisory capacity at all times when construction is in progress. A separate full-time superintendent will be required for each school site.

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§ 3.10.1 ~~The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and~~ Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path clearly defined. The schedule shall not exceed time limits current under the Contract Documents. ~~The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.~~For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not

be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals. Requirements for the submittal schedule are outlined in specification section 01 32 16, Construction Progress Schedules. If the Contractor fails to submit a submittal schedule or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in the Contract Sum or extension of the Contract Time based on the time required for review of submittals.

...

§ 3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. All schedule updates shall address the subject of how the Contractor intends to address any critical path delays previously encountered. The schedule and all updates should address submittal activities as well as actual field construction activities. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor's schedule shall be prepared in a format which at a minimum graphically portrays (1) the beginning and duration for each phase of the Work described in those specification sections included in the Project Manual, (2) a critical path, meaning a limited sequence of critical activities, which establishes a linked sequence of each critical activity, a delay to any of which will cause a delay in completion of the Work, and (3) the float, indicating an activity or sequence which does not necessarily have to start or end on the scheduled date(s) to maintain the schedule. Approval of a Contractor's schedule does not constitute a commitment by the Owner to furnish any Owner-furnished information or material any earlier than Owner would otherwise be obligated to furnish that information or material under the Contract Documents. Failure of the Work to proceed in the sequence scheduled by Contractor shall not alone serve as the basis for a Claim for additional compensation or time. In the event there is interference with the Work, which is beyond its control, Contractor shall attempt to reschedule the Work in a manner that will hold resulting additional time and costs to a minimum. The construction schedule shall be in a detailed format satisfactory to the Owner, the Architect and Program Manager. If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner, Program Manager and the Architect and re-submitted for acceptance. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. The accepted construction schedule shall be updated to reflect actual conditions (sometimes referred to in these General Conditions as progress reports) as set forth in Section 3.10.1 or if requested by either the Owner or the Architect. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

§ 3.10.5 The Contractor's schedule may be considered when requested extensions of time are evaluated. The Owner's need for delivery of completed Work, or portions thereof, is largely controlled by the necessities of the school calendar and operations of school programs within that calendar. These needs are reflected in any schedule completion dates and milestone dates set out in the Contract Documents. The Contractor shall perform the work in such a way as to not interfere with school operations, the importance of meeting milestones and completion dates. When it appears to Owner or Contractor that a Contract milestone or completion date cannot be met, Contractor will develop with the Owner, Program Manager and Architect a plan and a budget.

§ 3.10.6 The Owner shall have the right to reschedule the time of day for the performance of any part of the Work that may interfere with the operation of the Owner's premises or any tenants or invitees thereof. The Contractor shall, upon the Owner's request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any rescheduling of performance of the Work under this Section 3.10.6 may be grounds for an extension of the Contract Time, if permitted under Section 8.3.1, and an equitable adjustment in the Contract Sum, if: 1) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents, and 2) such rescheduling is required for the convenience of the Owner and is no attributable to any act or omission of Contractor.

~~The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and~~

~~delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.~~**§ 3.11.1** The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 In addition to any other requirement in the Contract Documents and prior to installation, Contractor is to furnish or cause subcontractor to furnish, for the Owner and Architect's written approval, a physical sample of each specified item, product, fixture or device which is visible by the general public and/or attached to an architecturally finished surface. Samples shall be suitably labeled, adequately protected and properly stored at the site. Samples which are approved and undamaged will be considered to be suitable for incorporation into the Work.
§ 3.11.1 The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

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.1 Submittals shall be submitted at the earliest possible time in order to expedite delivery of critical or long lead time items. For more complex systems and equipment (such as structural steel; doors, windows and hardware; casework; mechanical, electrical, and plumbing systems and equipment; food service equipment; sound systems and the like), the Contractor shall schedule at least 30 days for the Architect or the Architect's Consultants' review and submittals shall be sequenced logically in accordance with the schedule, required fabrication and installation time.

.2 Where colors are to be selected by the Architect, the Contractor shall submit all product color samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the Contract for Construction. Regarding critical delivery items, wherever feasible, the Architect will release color selections on critical materials as they are needed.

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.1 If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

.2 The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
~~**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.~~

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been ~~approved~~ accepted by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect

of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's ~~approval~~ acceptance thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's ~~approval~~ acceptance of a resubmission shall not apply to such revisions.

§ 3.12.9.1 Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing.
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§ 3.12.11 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least thirty (30) days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contact for construction.

§ 3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

§ 3.12.13 The Contractor shall provide MEP coordination drawings within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at ¼ inch per foot minimum scale and shall include invert elevations and sections required to meeting intended purpose. The Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

~~The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.~~ **§3.13.1** The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. When the Work is to be performed at an existing school location, Contractor shall schedule and perform the Work in a manner that does not compromise the safety to school students, faculty and staff, and does not unreasonably disrupt or interfere with the continuing normal routine of the school. If a School Operations Parameters Statement is a part of the Contract Documents, Contractor will comply with its terms, at no increase in price.

§ 3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction material and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

§ 3.13.3 The Contractor and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

§ 3.13.4 Contractor shall ensure that the Work, at all times, is performed in a manner that affords the Owner reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the

occupancy or beneficial use of: 1) any area and buildings adjacent to the site or the Work or 2) the building in the event of partial occupancy.

§ 3.13.5 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrance and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time

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§ 3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

...

§ 3.15.3 Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site; and make the Work ready in all respects for immediate and full use by the Owner.

§ 3.15.4 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor or deducted from the final payment to Contractor.

The Contractor shall provide the ~~Owner~~ Owner, Program Manager, their designated representative, and Architect with access to the Work in preparation and progress wherever located.

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§ 3.18.1 ~~To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.~~**TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR**

ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.

FOR ALL CLAIMS NOT ADDRESSED IN THE ABOVE PARAGRAPH, CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES AND (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, OF ANY NATURE WHATSOEVER ARISING OUT OF OR RELATED TO THIS AGREEMENT OR THE WORK TO BE PERFORMED UNDER THIS AGREEMENT, BUT ONLY TO THE EXTENT OF THE NEGLIGENCE OR OTHER FAULT OF THE CONTRACTOR, ITS AGENTS, REPRESENTATIVES, EMPLOYEES OR SUBCONTRACTORS OF ANY TIER.

§ 3.18.2 ~~In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.~~It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall **not** be obligated under Subparagraph 3.18 to indemnify or hold harmless Program Manager, Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

.1 defects in plans, designs or specifications prepared, approved or used by the Architect; or

.2 negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:

.1 personal injury or death;

.2 property injury; or

.3 any other expense that arises from personal injury, death or property injury.

§ 3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

§ 3.19 Record Drawings

§ 3.19.1 Refer Owner's Closeout Procedures

§ 3.20 Prevailing Wage Rates

§ 3.20.1 As required by Chapter 2258 of the Texas Government Code Title 10 Prevailing Wage Rate, no employee used in this construction may be paid less than the minimum prevailing wage rate in effect for the Owner.

§ 3.20.2 The Contractor and each Subcontractor and Sub-subcontractor shall pay to all laborers, workmen, and mechanics employed in execution of this Contract not less than rates set forth by law for each craft of type of workman or mechanic needed to execute this Contract.

§ 3.20.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates identified.

§ 3.21 Antitrust Violations

§ 3.21.1 Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

§ 3.22 Third-Party Beneficiary

§ 3.22.1 No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor

shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

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§ 4.1.3 Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Contract Documents by the responsibilities, activities or duties of the Architect.

§ 4.2.1 ~~The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have~~ Certain portions of the administration of the Contract will be performed by the Architect, others by the Program Manager. Both the Architect and the Program Manager will be treated as the Owner's representative to the extent set out in the Contract Documents. Neither the Architect nor the Program Manager shall have the authority to act on behalf of ~~the Owner only to the extent provided in the Contract Documents.~~Owner unless such authority is expressly granted in the Contract Documents, nor shall such authority be implied from any act or representation of the Architect or Program Manager..

§ 4.2.2 The ~~Architect~~ Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of ~~construction, or as otherwise agreed with the Owner, to become generally familiar with~~ the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the ~~Work observed~~ work is being performed in a manner indicating that the ~~Work,~~ work, when fully completed, will be in accordance with the Contract ~~Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for~~ documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under ~~the Contract Documents.~~the Contract Documents, except as provided in Section 3.3.1. Further:

.1 The Contractor expressly recognizes that the Architect does not owe him any duty to supervise or direct his work as to protect the Contractor from the consequences of his own acts or omissions.

.2 Upon reasonable request by the Owner, the Contractor shall accompany the Owner and Architect on an observation tour(s) of the building and shall note any defects and start remedying these defects within ten (10) days of the observation tour. Contractor shall prosecute the Work without interruption until accepted by the Owner and the Architect.

.3 Section 4.2.2, and the provisions of the Architect's Agreement with the Owner shall govern the number of site visits by the Architect. In this case, the Owner and Architect may agree in writing on an alternative site visit schedule that is appropriate for this particular project.

.4 If during the Architect's site visits the Architect observes any deviation from requirements of the Contract Documents, the Architect (or designee) shall report within three (3) business days to the Owner any such deviation. A copy of said report shall be sent to the Contractor. Failure to observe or report any deviation shall not be a waiver to subsequently require correction of the same, similar or other deviations.

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§ 4.2.6 The Architect ~~has~~ shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or ~~advisable,~~ advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with ~~Sections 13.4.2 and 13.4.3, whether or not the~~ the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall

give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of ~~the Work.~~
the Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

...

§ 4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

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§ 4.2.13 ~~The Architect's~~ All decisions on matters relating to aesthetic effect ~~will be final if consistent with the intent expressed in the Contract Documents.~~shall initially be made by the Architect; however, all such decisions are subject to the Owner's written approval.

...

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor. Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.
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§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed change**§ 5.2.5** The Contractor shall submit the list of proposed Subcontractors on AIA Document G805. The Contractor may obtain blank copies from the Architect.

§ 5.2.6 Contractor shall promptly notify the Owner, Architect and Program Manager of any material defaults by any subcontractor.

...

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the ~~subcontract.~~subcontract, but only to the extent permitted by law.

...

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. ~~If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~

...

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate ~~agreements.~~ agreements The Owner reserves the right to perform ~~construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.~~other construction work, maintenance and repair work and school program operations at the site and near the site during the time period of the Work. Owner may perform other Work with separate Contractors or forces. Owner shall have access to the building on the site at all times..

...

~~§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.~~

~~§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.~~

§ 6.1.3 The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the other until subsequently revised.

§ 6.1.4 It shall be the responsibility of the Contractor to assist, review, coordinate, and schedule work performed by any of Owner's separate contractors including the hazardous materials abatement contractor. Contractor shall not be required to contract directly with the hazardous materials abatement contractor's and Owner's separate contractor's work, including required monitoring, testing and inspections by independent firms, with the Work under this Agreement. The Contractor shall be totally responsible for coordination between its Subcontractors and the hazardous materials abatement contractor and any other Owner's separate contractors. Contractor will cooperate with the Owner to allow site access and staging areas for hazardous materials abatement contractor and Owner's separate contractors and consultants. Contractor shall review Owner's contract with the hazardous materials abatement contractor and Owner's separate contractors and become familiar with the requirements and scope of services contain therein. Contractor shall continually review the work performed by the hazardous materials abatement contractor and Owner's separate contractors and immediately notify the Owner and Program Manager if at any time during the performance of Contractor's work, the hazardous materials abatement contractor or any of Owner's separate contractors fail, in any way, to provide sufficient, competent manpower or timely perform its services.

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§ 7.1.1.1 No change in the Contract Sum and/or Contract Time will be allowed for a change in the Work unless, prior to performing the changed Work, the Contractor has provided the Owner in writing with a proposal for any change in price and/or change in Contract Time caused by the change in Work, and a Change Order is subsequently executed. A field directive or field order shall not be recognized as having any impact upon the Contract Sum or the Contract Time.

§ 7.1.1.2 Contingency Allowance Expenditure Authorization. A change in the work that does not require a change in Contract Sum or Contract Time may be paid from a designated Project Allowance. A Contingency Allowance Expenditure Authorization (CAEA) is a written order prepared by the Architect and signed by the Architect, Owner, Contractor and Program Manager directing a change in the Work.

§ 7.1.2 A Change Order shall be based ~~upon agreement among the Owner, Contractor, and Architect.~~ on agreement among the Owner's Board of Trustees, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4. or the Owner's assessment of liquidated damages as allowed by the Contract Documents. In such event, the Change Order is deemed approved by Contractor, and Contractor's signature(s) are not required. A Construction Change Directive requires agreement by the ~~Owner and Architect~~ Owner, or the Owner's representative, and Architect, and may or may not be agreed to by the ~~Contractor. An~~ Contractor; an order for a minor change ~~in the Work~~ may be issued by the Architect alone.
§ 7.1.2.1 Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the work or supply additional labor, services, or materials beyond that actually required by the terms of the Contract Documents, unless made pursuant to a written order from Owner authorizing Contractor to proceed with the change. No claim for an adjustment of the contract price will be valid unless so ordered.
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§ 7.2.2 Methods used in determining adjustments to the Contract Sum shall be determined in one or more of the ways

listed below. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected:

.1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Where additional Work is involved, any lump sum over the amount of $10,000.00 shall be broken down to represent the estimated cost of labor and materials plus mark-ups to cover overhead and profit.

.1 To compensate the Contractor, Subcontractor, or Sub-subcontractor actually performing a part of the Work for the combined cost of overhead and profit, the performing party shall be entitled to a single mark-up not to exceed 10% of the estimated cost of that part of the Work.

.2 To compensate (a) the Contractor for the combined cost of overhead and profit on Work performed by Subcontractors, or (b) Subcontractors for the combined cost of overhead and profit on Work performed by Sub-subcontractors, the Contractor or Subcontractor shall be entitled to a single mark-up not to exceed 5% of the subcontract amount.

.3 When a Sub-subcontractor performs the Work of a change, the maximum mark-up not to exceed 10% for combined overhead and profit shall be used only by the Sub-subcontractor. The Contractor and Subcontractor would each be entitled to a single mark-up not to exceed 5% of the cost to them for the Subcontractor and Sub-subcontractor, respectively.

.2 By Unit Prices stated in the Contract Documents or subsequently agreed upon. Additional mark-ups for overhead and profit will not be allowed in Unit Price work.

.3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee.

.4 Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.2.2 shall be limited to the costs established in Sections 7.3.7.1 through 7.3.7.5.

§ 7.2.3 Agreement on any Change Order shall constitute a final settlement of all claims by the Contractor directly or indirectly arising out of or relating to the change in the Work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs and impact costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time.

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§ 7.3.3 ~~If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:~~

~~**.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;~~

~~**.2** Unit prices stated in the Contract Documents or subsequently agreed upon;~~**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the methods described in Section 7.2.2 or as provided in Section 7.3.4.

~~**.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or~~

~~**.4** As provided in Section 7.3.4.~~

...

.4 Costs of premiums for all bonds and insurance, permit fees, ~~and sales, use, or similar taxes, directly related to the change;~~ directly related to the change and required by Contract Documents (unless the change is charged to an allowance already included in the Contract Sum, in which case additional mark-ups for these items will not be allowed; and

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§ 7.5 Allowable Markups for Changes in the Work

§ 7.5.1 Unless otherwise directed, the procedure and markup of the costs for additional work shall be determined in the following manner:

.1 Upon Change Proposal request, the Contractor shall quote the cost for changes in the work showing separately, credits and additional costs broken down by headings used in the Schedule of Values. Further breakdown into units of labor and materials may be required if agreement on cost cannot be reached using the breakdown by headings. The final cost shall be the amount of the Total Contract Value Change shown on the Change Proposal signed by the Contractor and Owner. For general construction work, not subcontracted, the Contractor shall consider as costs the actual invoice amount for additional materials, the sales tax on additional materials when applicable, the wages paid for additional direct labor, plus the Contractor's usual markup of wages to cover additional labor related costs such as insurance, taxes and fringe benefits.

.2 On changes executed within the Owner's Contingency Allowance, Contractor shall have included costs for combined overhead and profit, to the extent permitted by the Contract Documents, and General Conditions costs, including the cost of superintendents, field office expense, temporary facilities and services, small hand tools, construction equipment not specifically provided for the change in hand, home office expense, bond and building insurance premiums, and managing the Subcontractor's work, in his Base Contract amount. Allowed overhead and profit fee on Owner's Contingency Allowance changes to be included in the total cost to the Owner shall be based as follows:

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's of Sub-subcontractor's own forces, ten percent (10%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.

§ 7.5.2 If any additional Work is authorized outside of or in excess of the Owner's Contingency Allowance, the combined overhead and profit for this work shall be based as follows:

.1 For the Contractor, for Work performed by the Contractor's own forces, a maximum total markup of ten percent (10%) of the actual cost on a lump sum project, or the Contractor's Construction Phase Fee on a Guaranteed Maximum Price Project.

.2 For Work performed by the Contractor's Subcontractor(s), five percent (5%) of the amount due the Subcontractor(s).

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

.4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

§ 7.5.3 In order to facilitate checking of quotations for extras or credits, all proposals, (except those so minor that their propriety can be seen by inspection), shall be accompanied by a complete and detailed itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

§ 7.5.4 Change orders, as they are accepted by the Owner, shall be entered under heading "Change Orders" in the next current Request for Payment.

§ 7.5.5 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5. All unused Contingency or Allowance amounts shall be credited back to Owner prior to final payment, along with any markups included in the Contract Sum or GMP on such unused amounts.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined. See further definition of "Day" in Section 1.9.10.§ 8.2 Progress and Completion
~~§ 8.2 Progress and Completion~~

...

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by ~~(1)~~ an act or neglect of the Owner or Architect, or of an employee of either, or of a ~~Separate Contractor; (2)~~ separate contractor employed by the Owner, or by changes ordered in the ~~Work; (3)~~ Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable ~~casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines,~~ casualties or other unforeseeable causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. **No extensions of the Contract Time will be granted for inclement weather, except for Force Majeure events consisting of named storms or government declared emergencies resulting from extreme weather.**

...

§ 8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadline for substantial completion and Contractor's achievement of substantial completion.

§ 8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within sixty (60) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase, for each and every Calendar Day beyond the 60-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of sixty (60) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

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§ 9.1.1.1 The Owner is exempt from payment of Texas State Sales Tax on materials required for the Work. Therefore, to comply with the law, the Contract Sum shall be broken down into the amount of cost for labor and the amount of cost for materials. This breakdown shall be provided by the Contractor within ten (10) days of award of Contract.

...

~~Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.~~**§ 9.2.1** Before the first Application for Payment, the Contractor shall submit to the Architect and Program Manager a schedule of values fairly allocating the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as reasonably required by the Architect and Program Manager, and updated for changes in the Work, the schedule of values shall be used only as a basis for reviewing the Contractor's Applications for Payment and is not to be taken as evidence of market or other value. The schedule shall not overvalue early job activities. Each item shall include a pro-rata portion of overhead and profit. The schedule shall follow the divisions of the Specifications so far as practicable and shall contain line items for equipment and system start up and testing.

§ 9.2.1 General Contractor's cost for Contractor's fee, bonds and insurance, General Conditions, etc., shall be listed as individual line items.

§ 9.2.2 Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

§ 9.2.3 Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items.

§ 9.2.4 On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicated line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

§ 9.2.5 Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

§ 9.2.6 The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

§ 9.2.7 The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balance requirements.

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§ 9.3.1 ~~At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.~~No later than 3 working days prior to the first Wednesday of each month, submit an itemized Application for Payment, supported by such data sustaining the Contractor's right to payment as the Owner or Architect may require, and reflecting retainage, as provided elsewhere in the Construction Documents. Information on the form shall be divided into the same last day of the month preceding, which shall also be the basis of payment or as agreed by the Owner, Contractor and Architect by verification at the site, prior to submittal.

§ 9.3.1.1 As provided in ~~Section 7.3.9,~~ Section 7.3.9, such applications may include requests for payment on account of changes in the Work ~~that~~ which have been properly authorized by Construction Change ~~Directives, or by interim determinations of the Architect,~~ Directives but not yet included in Change Orders.

§ 9.3.1.2 ~~Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.~~Contractor agrees, for purposes of Texas Government Code 2251.042, receipt of the

Certified Applications for Payment from the Architect shall not be construed as receipt of an invoice by the Owner. Contractor further agrees that Program Manager's receipt of the Certificate of Payment shall be construed as receipt of an invoice by the Owner, for purposes of Texas Government Code Section 2251.042

§ 9.3.2 ~~Unless otherwise provided in the Contract Documents, payments shall~~ Payments will be made on account of materials ~~and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and~~ or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon ~~compliance by the Contractor with~~ submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials ~~and~~ or equipment or otherwise protect the Owner's interest, ~~and shall include the costs of applicable insurance, storage, and transportation to the site, for such~~ including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

...

§ 9.3.4 The Contractor shall submit requests for payment in duplicate, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

§ 9.3.5 The Contractor shall submit the Fort Bend ISD Subcontractor Progress Assessment Form with each application for payment requesting payment be made for Work performed by a subcontractor that qualifies as a "small business" pursuant to FBISD Board Policy CV (Local). The Contractor shall also ensure that, once Contractor makes the applicable payment to the Small Business Subcontractor, the Subcontractor completes the Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form in its entirety and Contractor agrees to submit the completed copies to Owner with the next application for payment. The completed Fort Bend ISD Subcontractors/Subcontractors/Suppliers Payment Certification Form must be received by the Owner before any further payment will be made to Contractor for any Work performed.

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§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect and Program Manager to the Owner, based on the Architect's and Program Manager's evaluation of the Work and the data ~~in the Application for Payment,~~ comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's ~~knowledge, information, and belief, the Work has progressed to the point indicated, the~~ and Program Manager's knowledge, information and belief, the quality of the Work is in accordance with the Contract ~~Documents, and that the Contractor is entitled to payment in the amount certified.~~ Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, ~~to~~ the results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to ~~completion,~~ completion and to specific qualifications expressed by the ~~Architect.~~

~~However, the~~ Architect and Program Manager. The issuance of a Certificate for Payment will not be a representation that the Architect and Program Manager has (1) made exhaustive or continuous on-site inspections to check the quality ~~or quantity~~ of the ~~Work;~~ Work, (2) reviewed construction means, methods, techniques, ~~sequences, or procedures;~~ sequences or procedures, (3) reviewed copies of requisitions received from the Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to ~~payment;~~ Payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

...

The Architect or Program Manager may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the ~~Architect's~~ Architect or Program Manager's opinion the representations to the Owner required by ~~Section 9.4.2~~ Section 9.4.2 cannot be made. If the Architect or Program Manager is unable to certify payment in the amount of the Application, the Architect or Program Manager will notify the Contractor and Owner as provided in ~~Section 9.4.1.~~ Section 9.4.1. If the Contractor and Architect or Program Manager cannot agree on a revised amount, the Architect or Program Manager will promptly issue a Certificate for Payment for the amount for which the Architect or Program Manager is able to make such representations to the Owner. The Architect or Program Manager may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the ~~whole~~ or ~~a~~ part of a Certificate for Payment previously issued, to such extent ~~as may be necessary~~ necessary, in the Architect's ~~opinion~~ or Program Manager's opinion, to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in ~~Section 3.3.2, because of~~Section 3.3.2, because of:

~~.1 defective~~ 1. Defective Work not remedied;

~~.2 third~~ 2. Third party claims ~~filed~~ field or reasonable evidence indicating probable filing of such ~~claims,~~ claims unless security acceptable to the Owner is provided by the Contractor;

~~.3 failure~~ 3. Failure of the Contractor to make payments properly to Subcontractors or ~~suppliers~~ for labor, materials or equipment;

~~.4 reasonable~~ 4. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

~~.5 damage~~ 5. Damage to the Owner or ~~a Separate Contractor;~~another contractor;

~~.6 reasonable~~ 6. Reasonable evidence that the Work will not be completed within the Contract ~~Time,~~ Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;~~or~~

~~.7 repeated~~ 7. Persistent failure to carry out the Work in accordance with ~~the Contract Documents.~~ the Contract Documents; or

8. Failure to submit a written plan indicating action by the Contractor to regain the time schedule for completion of Work within the Contract Time

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§ 9.5.5 If the work has not attained Substantial Completion by the date agreed upon and set forth in the Amendments, subject to extensions of time as described in the Contract Documents, Owner may, in sole discretion, direct Architect or Program Manager to withhold payment to Contractor to the extent necessary to reserve sufficient funds to complete the construction of the Project and to cover liquidated damages assessed against Contractor up to the time of the Application for Payment and to the time it is reasonably anticipated Substantial Completion will be achieved. The Owner shall not be deemed in default by reason of withholding payment as provided for in Sections 9.3.4, 9.4.3, 9.5.1, or this Section.

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make ~~payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.~~progress payments in accordance with the following Section which shall be inserted as Article 5, Progress Payments, in the Owner-Contractor Agreement, AIA Document A101, 2017 Edition.

.1 Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period ending the last day of the month as follows:

.2 Not later than twenty (20) working days following the first Wednesday of each month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly

allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing, for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner. Applications for Payment shall be submitted by the first Wednesday of the month.

.3 Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

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§ 9.6.9 Within seven (7) calendar days of receipt of payment from the Owner, the Contractor shall pay each subcontractor, out of the amount of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payment to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner. Owner is not obligated to monitor payments to Subcontractors or Sub-subcontractors, and nothing in this section shall create any right on the part of a Subcontractors or Sub-subcontractor against Owner, Architect or Program Manager. In compliance with Texas Government Code Section 2251.022, the Contractor shall, within ten (10) days following receipt of payment from the Owner, pay all bills for labor and materials performed and furnished by others in connection with the Work, and shall, if requested, provide the Owner with evidence of such payment. Contractor's failure to make payments within such time shall constitute a material breach of this Contract. Contractor shall include a provision in each of its Subcontractor's imposing the same payment obligations on its Subcontractors as are applicable to the Contractor hereunder, and if the Owner so requests, shall provide copies of such Subcontractor payments to the Owner. If the Contractor has failed to make payment promptly to the Contractor's Subcontractors or for materials or labor used in the Work for which the Owner has made payment to the Contractor, then the Owner shall be entitled to withhold payment to the Contractor in part or in whole to the extent necessary to protect the Owner.

§ 9.6.10 Contractor shall not withhold as retainage a greater percentage on Subcontractors or material men than the percentage Owner withheld as retainage from payments to the Contractor.

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within ~~seven~~ ten days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within ~~seven~~ ten days after the date established in the Contract Documents, the amount certified by the Architect ~~or awarded by binding dispute resolution,~~ , then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

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§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract ~~Documents.~~Documents In order to initiate and facilitate the preparation of the Contractor's list of items to be completed or corrected (Punch List), the Architect and Program Manager, if requested by the Contractor, will inspect a few representative rooms with the Contractor's superintendent and the office project manager to assist the Contractor in the preparation of the Contractor's Punch List. The Contractor's superintendent shall participate in the preparation of the Contractor's Punch List that is submitted to the Architect and shall personally inspect each and every item himself before certifying to the Architect that listed items have been corrected. Should the Architect determine that the Contractor's Punch List lacks sufficient detail or requires extensive supplementation, the Punch List will be returned to the Contractor for revision and the inspection for determining the Date of Substantial Completion will be delayed until the Punch List submitted is a reasonable representation of the work to be completed. To further facilitate completion of the Work the

Contractor's superintendent shall accompany the Architect and his consultants during their inspections and the preparation of their supplements to the Punch List and the superintendent shall record or otherwise take note of those supplementary items. The Architect will endeavor to furnish to the Contractor typed, hand-lettered, written or recorded supplements to the Punch List in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect shall not be cause for a claim for additional cost or extension of time as the Contractor's superintendent shall have been in attendance during the inspections of the Architect and his consultants and will have been expected to taken his own notes. Furthermore, a significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judges of what constitutes a significantly large number of items.

...

§ 9.8.6 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

.1 All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

.2 All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

The following items are a partial specific list of requirements, as applicable to the Project, that must be completed **prior** to established Substantial Completion of all portions of the work (Including the Substantial Completion of the commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.
6. All required commissioning must be complete.
7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All room plaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
12. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.

§ 9.8.7 After the date of Substantial Completion of the Project, as evidenced by the Certificate of Substantial Completion, G704 current edition, the Contractor will be allowed a period of thirty (30) days (unless extended by mutual agreement or provision of the Contract) within which to correct all deficiencies attached to the Certificate of Substantial Completion. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the Contractor's Surety. In the report of deficiency, the Contractor and Surety will be informed that, should correction remain incomplete for fifteen (15) additional days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Section 14.2. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete the correction of deficiencies within thirty (30) days after the date of Substantial Completion (unless extended by mutual agreement or provision of the Contract) may be deducted from the funds remaining to be paid to the Contractor. Should corrective work following Substantial Completion require more than one reinspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from funds remaining unpaid to the Contractor.

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§ 9.10.1 Upon receipt of ~~the Contractor's~~ written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such ~~inspection. When the Architect~~ inspection and, when the Architect and the Program Manager finds the Work acceptable under the Contract Documents and the ~~Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and~~ Contractor fully performed, the Architect and the Program Manager will promptly prepare, sign and issue a Certificate of Final Completion and a final Certificate for Payment certifying to the Owner that, on the basis of the Architect's and the Program Manager's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire ~~balance~~ balance, including all retainages found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's and the Program Manager's final Certificate for Payment will constitute a further representation that conditions listed in ~~Section 9.10.2~~ Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees. Prior to final payment, the Contractor shall meet all of the requirements of Owner's Closeout Procedures.**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

~~**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.~~

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§ 9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor thirty-one (31) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, and the Final Certificate for Payment has been issued by the Architect.

The final payment will not be made until all of these conditions have been satisfied.**§ 9.10.7** Contractor agrees that the Owner may place and install as much equipment and furnishings during the progress of the building as is possible before completion of the various parts of the Work, or may occupy portions of the Work before substantial completion of the entire Work, and further agrees that such placing and installing of equipment and furnishings or occupancy of portions of the Work shall not in any way evidence the substantial completion of the entire Work, or signify Owner's acceptance of the Work, nor does it affect claims for liquidated damages in case Substantial Completion is not achieved as required unless the failure to reach Substantial Completion is the result of the early move-in or occupancy. Owner will assume the responsibility for any damages to the Work caused by such occupancy.

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§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract and shall conform to all provisions of the "Manual of Accident Prevention in Construction", published by the Associated General Contractor of America, Inc. latest edition and the Contractor further agrees to fully comply with all safety standards required by the Occupational Safety and Health Administration (:OSHA") 29 USC Section 651 et seq,. and all amendments thereto. However, the Contractor's duties herein shall not relieve any Subcontractor and any other person or entity, including any person or entity required to comply with all applicable federal, state and local laws, rules, regulations, and ordinances, form the obligation to provide for the safety of their employees, persons and property and their requirements to maintain a work environment free of recognized hazards.

§ 10.1.2 Contractor's employees, agents, Subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, shall not perform any service for Owner while under the influence of any amount of alcohol or any controlled substance, or use, posses, distribute, or sell alcoholic beverages while on Owner's premises. No person shall use, possess, distribute, or sell illicit or unprescribed controlled drugs or drug paraphernalia; misuse legitimate prescription drugs; or act in contravention of warnings on medications while performing the Work or on Owner's premises.

§ 10.1.3 Contractor has implemented it's own Safety Manual to assure a drug-free and alcohol-free workplace while on Owner's premises or performing the Work. Contractor will remove any of its employees, agents, subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such person, and at any time an accident occurs where drug or alcohol use could have been a contributing factor, Owner has the right to require Contractor to remove any person from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, the person so removed may only be considered for return to work after the Contractor certifies as a result of a for-cause test, conducted immediately following removal that said person was in compliance with this Contract. Contractor will not use any person to perform the Work who fails or refuses to take, or tests positive on, any alcohol or drug test.

§ 10.1.4 Contractor will comply with all applicable federal, state and local drug and alcohol-related laws and regulations (e.g., Department of Transportation regulations, Drug-Free Workplace Act). Owner has also banned the presence of all weapons on the Project site, whether or not the owner thereof has a permit for a concealed weapon, and the Contractor agrees that the Contractor's representative, employees, agents, and sub-contractors will abide by the same.

...

§ 10.2.3 The Contractor shall ~~implement, erect,~~ erect and maintain, as required by existing conditions and performance of the Contract, reasonable ~~safeguards~~ safeguards, for safety and protection, including posting danger signs and other warnings against ~~hazards;~~ hazards, promulgating safety ~~regulations;~~ regulations and notifying ~~the~~ owners and users of adjacent sites ~~and utilities of the safeguards.~~and utilities. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property for improvements shall be promptly repaired by the Contractor. Contractor shall provide reasonable fall protection safeguards and provide approved fall protection safety equipment for use by all exposed Contractor employees.

§ 10.2.4 When use ~~or~~ of storage of ~~explosives or other~~ hazardous materials or ~~equipment,~~ equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such ~~activities under supervision of properly qualified personnel.~~
under supervision of properly qualified personnel, and shall only conduct such activities after giving reasonable advance written notice of the presence or use of such materials, equipment or methods to Owner and Architect. The storage of explosives on Owner's property is prohibited. The use of explosives materials on Owner's property is prohibited unless expressly approved in advance by authorities having jurisdiction and in writing by Owner and Architect. When use or storage of hazardous materials or equipment or unusual construction methods are necessary, the Contractor shall give the Owner, Program Manager and the Architect reasonable advance notice of the presence or use of such materials, equipment, or methods.
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§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect. Additionally, Contractor shall submit a Safety Plan for the Owner's approval prior to commencing the Work which meets or exceeds the minimum requirements set forth in the provisions of the FBISD Safety Plan. Unless otherwise specified in the Contract Documents, Contractor shall be responsible for initiating, maintaining, supervising, and enforcing all safety precautions and programs in connection with the Work. It shall be the duty and responsibility of the Contractor and all of its Subcontractors to be familiar and comply with all requirements of Public Law 91-596,29 U.S.C. § 651 et. Seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all the provisions of the Act. Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property to protect them from damage, injury or loss and shall erect and maintain all necessary safeguards for such safety and protection. However, the Contractor's duties shall not relieve any subcontractor(s) or any person or entity (e.g. a supplier) including any person or entity with liability relative to compliance with all applicable federal, state and local laws, rules, regulations, and ordinances which shall include the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards.

...

§ **10.2.9** The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

§ **10.2.10** The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

§ 10.2.11 The Contractor shall promptly report in writing to the Owner, Program Manager and Architect all accidents arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statement of any witness. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Program Manager and the Architect.

§ 10.2.12 The Contractor shall be responsible for the protection and security of the Work until it receives written notification that the Substantial Completion of the Work has been accepted by the Owner.

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous ~~materials or substances.~~ materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or ~~substance, including but not limited to asbestos or polychlorinated biphenyl (PCB),~~ substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and ~~notify the Owner and Architect of the condition.~~report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Section 10.3.2.

§ 10.3.1.1 Owner and Contractor may enter into a separate agreement and/or Change Order for Contractor to remediate and/or render harmless the Hazardous Substance, but Contractor shall not be required to remediate and/or render harmless the Hazardous Substance absent such agreement. Contractor shall not be required to resume work in any area affected by the Hazardous Substance until such time as the Hazardous Substance has been remediated and/or rendered harmless.

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~~**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.~~

~~**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.~~

~~**§ 10.3.5** The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.~~

~~**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.~~

§ 10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

...

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

~~**§ 11.1.1** The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.~~

~~**§ 11.1.2** The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.~~

~~**§ 11.1.3** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.~~

~~**§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.~~

~~**§ 11.2 Owner's Insurance**~~

~~**§ 11.2 § 11.2.1** The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.~~ **§ 11.2.1 § 11.2.2 § 11.2.3 § 11.2.4 § 11.2.5 § 11.2.6 intentionally deleted.**

Please refer to Exhibit A to AIA Document A133-2009, Insurance and Bond Requirements.

~~**§ 11.2.2 Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~

~~**§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.~~

~~**§ 11.3 Waivers of Subrogation**~~

~~**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.~~

§ 11.3 The Owner requires that the following insurance requirements be satisfied:

.1 No Work shall be commenced until all insurance requirements set forth in this Agreement have been approved by the Owner in writing.

.2 All insurance policies and certificates required hereunder shall be in form and content satisfactory to the Owner.

.3 The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and endorsements required by this Agreement prior to execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written notice shall be given to the Owner in the event of cancellation, material change, or non-renewal.

.5 Insurance shall be underwritten by a company licensed to do business in Texas, satisfactory to Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one (1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent of the Owner.

.8 All insurance except Professional Liability must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the Owner as Additional Insures, and (b) showing waivers of subrogation in favor of the Owner.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum if the formal contract is in excess of Twenty Five Thousand Dollars ($25,000.00).

§ 11.4.2 The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

§ 11.4.3 The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds land as Acceptable Reinsuring companies.

§ 11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

§ 11.4.5 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety. The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no responsibility because of any representation by any agent or employee.

§ 11.5 Worker's Compensation Insurance

§ 11.5.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or

Construction Projects for Governmental Entities

§ 11.5.2 Definitions:

.1 Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing service as on a project, for the duration of the project.

.2 Duration of the project –includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

§ 11.5.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

§ 11.5.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

§ 11.5.5 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

§ 11.5.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

.1 A certificate of coverage, prior to that person beginning work on the projects so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project, and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

~~**§ 11.3.2** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.~~**11.5.7** The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

~~**§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**~~

~~The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

~~**§11.5 Adjustment and Settlement of Insured Loss**~~

~~**§ 11.5.1** A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to~~

~~requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.~~

~~**§ 11.5.2** Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.~~

§ 11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

§ 11.5.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Worker's Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack coverage.

§ 11.5.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

- **.1** Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meet the statutory requirements of Texas Labor code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project.
- **.2** Provide the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.
- **.3** Provide the Contractor, prior to the end of the coverage period shown on the current certificate ends during the duration of the project.
- **.4** Obtain from each other person with whom it contracts, and provides to the Contractor:
  - **.1** A certificate of coverage, prior to the other person beginning work on the project, and
  - **.2** A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
- **.5** Retain all required certificates of coverage on file for the duration of the project and for one year thereafter.
- **.6** Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and
- **.7** Contractually require each person with whom it contracts, to perform as required by these subsections (1)-(7), with the certificates of coverage to be provided to the person for whom they are providing services.

§ 11.5.11 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other actions.

§ 11.5.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

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The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. The Owner may make emergency repairs to the Work or take such other measures necessary under the circumstance, if the Contractor does not promptly respond to a Notice of Defect or nonconforming Work. Contractor shall be responsible to Owner for this cost if the reason for the repairs is attributable to the Contractor. If payments then or thereafter due to the Contractor are not sufficient to cover such costs, then the Contractor shall pay the difference to the Owner on demand.

§ 12.2.1.1 In the event of failure of a specified project, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

§ 12.2.1.2 Refer to 01 77 00, Closeout Procedures in Division One for further terms regarding warranties which will be required prior to final payment.

§ 12.2.1 ~~In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.~~Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

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~~If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.~~**§ 12.3.1** If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

§ 12.3.2 The Owner's use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner's acceptance is provided to the Contractor in writing.

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§ 13.7 Equal Opportunity

§ 13.7.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during

employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 13.8 Criminal Background Checks

The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Fort Bend ISD Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

§ 13.9 Required Certifications

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor hereby certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

Contractor verifies that: (1) it does not, and will not for the duration of the contract, boycott energy companies or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

Contractor verifies that: (1) it does not, and will not for the duration of the contract, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

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§ 14.2.5 The Contractor hereby assigns the Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et. Seq. (1973).

§ 14.2.6 If a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, the Surety shall promptly remedy the default by completing the Contract in accordance with its terms and conditions, or by obtaining a bid or bids in accordance with its terms and conditions. At Owner's election, upon determination by the Owner and the Surety of the lowest responsible bidder, the Surety will complete the Work or will arrange for a Contract between such bidder and the Owner, and make available as Work progresses sufficient funds to pay the cost of completion less the balance of the Contract Sum, but not exceeding the Penal Sum of the bond and other costs and damages for which the Surety may be liable under the bond. The phrase 'balance of the Contract Sum' as used herein shall mean the total amount payable by the Owner to the Contractor under the Contract and amendments thereto less the amount previously paid by the Owner to the Contractor.

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§ 14.4.3 In the case of such termination for the Owner's convenience, the ~~Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

...

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. ~~The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.~~

...

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party ~~under this Section 15.1.3.1 shall~~ must be initiated within ~~21~~ ninety (90) days after occurrence of the event giving rise to such Claim or within ~~21~~ ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Contractor agrees that this is a reasonable Notice requirement. Any Claim or portion of a Claim that has not been made the specific subject of a Notice strictly in accordance with the requirements of this section is waived.

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§ 15.1.6.2 ~~If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.~~**No extensions of the Contract Time will be granted for inclement weather, except as stated in Section 8.3.1.**

~~.~~

~~**§ 15.1.7 Waiver of Claims for Consequential Damages**~~

~~The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes~~

~~.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and~~

~~.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.~~

~~This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.~~

§ 15.2.1 Claims, excluding those ~~where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5,~~ arising under Sections 11.3.9 and 11.3.10, or claims alleging an error or omission by the Architect, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. ~~Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.~~If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

...

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the ~~Initial~~ initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons ~~therefor;~~ therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the ~~parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.~~parties, but subject to mediation, if both parties so agree, and subject to legal or equitable

proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

~~**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.~~

~~**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.~~

~~**§ 15.2.8** If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.~~

§ 15.2.9 The prevailing party in any judicial proceeding arising from the Contract Documents shall recover its reasonable and necessary attorneys' fees.

~~**§ 15.3.1** Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.~~

§ 15.3.2 The parties ~~shall endeavor~~ may mutually agree to resolve their ~~Claims~~ claims by mediation which, unless the parties mutually agree otherwise, shall be ~~administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution~~ in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of ~~filing,~~ filing unless stayed for a longer period ~~by~~ of agreement of the parties or court order.~~If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~

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~~**§ 15.4.1** If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~

~~**§ 15.4.1.1** A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

~~**§ 15.4.2** The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

~~**§ 15.4.3** The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

~~**§ 15.4.4 Consolidation or Joinder**~~

~~**§ 15.4.4.1** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).~~

~~**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.~~

ARTICLE 16 Contractor Accounts, Records, and Inspection

Contractor shall at all times maintain job records, including, but not limited to, invoices, payment records, payroll records, daily reports, logs, diaries, and job meeting minutes, applicable to the project. Contractor shall make such reports and records available to inspection by the Owner, Architect, or their respective agents, within five (5) working days of request by Owner, Architect, or the respective agents. Job Records must be retained by Contractor for at least seven (7) years after the date of Final Completion of the Project. Furthermore, the Contractor shall promptly provide copies, including by electronic means, of all documents that may be required by the State Public Information Act.

ARTICLE 17 Business Ethics

§ 17.1 During the course of pursuing contracts, and the course of Contract performance, Contractor and its Subcontractors and vendors will maintain business ethics standards aimed at avoiding real or apparent impropriety or conflicts of interest. No substantial gifts, entertainment, payments, loans or other considerations beyond that which would be collectively categorized as incidental shall be made to any personnel of the Owner, its Program Managers, or its Architects, or to family members of any of them. At any time Contractor believes there may have been a violation of this obligation, Contractor shall notify Owner of the possible violation. Owner is entitled to request a representation letter from Contractor, its Subcontractors or vendors at any time to disclose all things of value passing from Contractor, its Subcontractors or vendors to Owner's personnel, its Program Managers and its Architects.

§ 17.2 The Owner may, by written notice to the Contractor, cancel the Contract for Construction without liability to the Contractor if it is determined by the Owner that gratuities, in the form of entertainment, gifts, or anything of monetary value, were offered or given by the Contractor, or any agent, or representative of the Contractor, to any officer or employee of the Fort Bend Independent School District with a view toward securing a contract or securing favorable treatment with respect to the awarding, amending, or making of any determinations with the respect to the performing of such a contract. In the event the Construction Agreement is cancelled by the Owner pursuant to this provision, Owner shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by the Contractor in providing such gratuities.

~~**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:50:35 ET on 03/31/2022 under Order No. 2114291871 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

FBISD
INSPIRE•EQUIP•IMAGINE

Exhibit A

FORT BEND I.S.D. CONSTRUCTION BOND & INSURANCE REQUIREMENTS

It is suggested that this Exhibit be provided to the Contractor's insurance provider.

Contractor shall not commence work until all required bonds and insurance coverages have been obtained and such insurance has been reviewed and accepted by the District. Certificates of Insurance on the current ACORD form shall be issued to the District showing all required insurance coverages.

Bonds Required

Construction, installation and service contracts (including repair and alteration) exceeding $100,000 requires that a 100% Performance Bond be furnished by the successful bidder (contractor). Contracts exceeding $25,000 require that a 100% Payment Bond be furnished by the successful bidder (contractor). All such bids must include a 5% Bid Bond.

Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of at least A- X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570). The contractor shall be responsible for obtaining bonds and shall absorb any and all costs of such Bonds.

Insurance Required	**Limit Required**
Automobile Liability insurance covering Any Auto	$1,000,000 Combined Single Limit
Comprehensive (Commercial) General Liability insurance including Products, Completed Operations, Independent Contractors, Broad Form Property Damage, Pollution and Blanket Contractual Liability coverages. XCU exclusions to be removed when underground work is performed.	$1,000,000 Occurrence $2,000,000 Aggregate $1,000,000 Personal Injury $ 500,000 Fire Damage $ 5,000 Medical Payments Per Project Aggregate (CG 70 49) Evidence of coverage must be shown on certificates of insurance.
Professional Errors & Omissions Liability insurance may be required from all contractors and licensed or certified as professionals; e.g., engineer architects, insurance agents, physicians, attorneys, banks, financial consultants, etc.	One time project amount; $1,000,000 Occurrence & Aggregate minimum, $5,000,000 Maximum Limit Retroactive Date preceding date of contract must be shown Extended Reporting Period three years past completion of contract
Workers Compensation insurance with limits to comply with the requirements of the Texas Worker Compensation Act Employers Liability insurance	Statutory Limits $1,000,000
Umbrella or Excess Liability insurance (excess of primary General Liability, Automobile Liability and WC Coverage B) Applicable to minimum contract amounts **of $100,000**	100% of Contract Amount up to a maximum of $25,000,000. For construction contracts in excess of $25,000,000 higher limits may be required.

Limits for primary policies may differ from those shown when Umbrella or Excess Liability insurance is provided.

All Risk Builders Risk Property Insurance shall be required for all construction contracts when property of the owner is at risk or in the care, custody and control of the Contractor. Builders Risk insurance shall be required for all construction contracts requiring a bond. All Property insurance shall include coverage against the perils of Flood and Earthquake. (Installation Floater may be substituted when contract involves installation only.)	Contract Limit or Replacement Cost Value of Scope of Work whichever is greater Permission to Occupy granted Deductible: 1% of contract, $50,000 maximum, unless otherwise approved by the Owner.

Insurance Conditions

All insurance coverages shall be issued on an Occurrence basis (except Professional Liability) by companies acceptable to District and licensed to do business in the State of Texas by the Texas Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".

All certificates must include:

1. The location or description and the bid number, CSP number or Purchase Order number
2. A 30 day notice of cancellation of any non-renewal, cancellation or material change to any of the policies
3. "Additional Insured" on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District.
4. A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies.
5. In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the District as Additional Insured, and (b) showing waivers of subrogation in favor of the District: CG2010, CG2037, CG2404, CA0070, CA0032, WC0003 or their equivalents.

All insurance must be maintained for one year following substantial completion with Certificates of Insurance provided.

Contractor shall be responsible for payment of all deductibles; the District shall approve the deductibles selected.

If any policy has aggregate limits, a statement of claims against the aggregate limits is required.

The District reserves the right to review the insurance requirements during the effective period of any contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.

FORT BEND Independent School District
C/o Director – Design & Construction Department
2323 Texas Parkway
Missouri City, TX 77489

DEVIATION REQUEST FORM

Instructions to Bidders: No deviations are allowed in the Base Bid or Base Bid Adjustment. Deviations shall be submitted on the Deviations Form as Alternate 2. *Complete this form, attach any supporting data and submit with Package B.*

Project Title and Number:		
Deviation Request No.	Date Submitted:	Specification Section, and/or Drawing No:
Item Description:		

Reason for Deviation: *(If specified product, material or detail cannot be provided, include statement indicating why and provide supporting information.):*
Differences (point-by-point comparative data) between proposed deviation and specified product, material or detail:

Proposed deviation affects other parts of the project : ☐ YES ☐ NO

Explain:

Time Impact due to Deviation: ☐ YES ☐ NO ☐ ADD ☐ DEDUCT Days

Anticipated deviation savings and/or benefit to the District:

$_____

Date:

Printed Name of Authorized Representative:

Signature of Authorized Representative:

A/E Recommendation:

Deviation Request approved to proceed with deviation:

Deviation Request rejected:
Use specified product

Notes: Date:

Additional Information if Applicable

Reason for Deviation: *(If specified product, material or detail cannot be provided, include statement indicating why and provide supporting information.)*

Differences (point-by-point comparative data) between proposed deviation and specified product, material or detail:

PART 1 GENERAL

1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
- A. Section includes:
  1. Project information
  2. Work covered by Contract Documents
  3. Phased construction
  4. Access to site
  5. Coordination with occupants
  6. Work restrictions
- B. RELATED SECTIONS:
  1. Division 00 FBISD Procurement Forms
  2. Division 01 Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities
  3. Division 01 Section 01 52 14 “Temporary Facilities for Students” for specifications and procedures regarding the use of temporary swing space that the Contractor may furnish and install to accommodate the Work

1.3 PROJECT INFORMATION
- A. Refer to Section 00 FBISD Procurement Forms

1.4 SCOPE OF WORK. The Work consists of:
1. Renovation and Expansion project at Bush High School's Fine Arts facilities.
   a. This project encompasses several key areas like the Auditorium and support spaces, Black Box Theater and existing Fine Arts Suite. Additionally includes Mechanical, Audio Visual, lighting, finishes upgrades and the construction of the Fine Arts Building expansions, which incorporates the surrounding site work.

1.5 MULTIPLE PROJECT SITE REPRESENTATION FOR BID PACKAGES. If multiple project sites are identified in the Work, the contractor shall employ and designate one qualified full-time Superintendent who shall oversee the performance for the overall work performed under the contract. The daily work is required to have a qualified supervisor for the duration of the work. Any deviation from this will need to be approved by FBISD and the Owner’s representative.

1.6 SCHEDULE OF VALUES FOR BID PACKAGES. If multiple project sites are identified in the Work, the contractor shall provide one Schedule of Values for each project site attached to each application for payment. In addition, each school site shall have a separate schedule of values in current CSI format for Renovation Work and for Addition Work, identifying the labor and material components separately.

1.7 CONCURRENT CONSTRUCTION FOR BID PACKAGES. Work (additions and renovations) at each school site will be performed concurrently with the other school sites unless otherwise indicated by FBISD.

1.8 PHASING. If the school buildings will be in use during construction, the Work shall be conducted in such a manner as to not interrupt or disturb school activities. Phasing plans are guidelines and are used to identify a possible approach to the work. *The contractor may* submit a phasing plan for all scopes of work taking place when requested. Any deviation from the suggested plan contained in the contract documents must be approved by the A/E, owner or owner's representative, and Principal prior to implementation.

A. Temporary classroom space (Swing Space) if needed, shall be provided by the Contractor or coordinated at the campus. When Contractor is to provide temporary classroom(s), they will be responsible for all associated planning, permitting, scheduling, installation, removal, site restoration, coordination and costs associated with providing temporary space for classrooms. Temporary classroom space will be in accordance with Section 00 52 14 - TEMPORARY FACILITIES FOR STUDENTS. The Contractor may submit, as part of the proposal, optional phasing plans that can potentially save the District time and money.

B. Some work may need to be performed after normal school operating hours, nights and weekends. If an owner's representative is required outside normal hours of school operation, FBISD will incur overtime costs for FBISD staff presence at the school site, including weekends and holidays. Such overtime costs incurred may become the financial responsibility of the General Contractor and will be credited to the Owner. Determination of need for reimbursement will be made by FBISD and the owner's representative prior to the start of construction. FBISD and owner's representative reserve the right to alter the decision based on contractor performance.

C. Refer to the School Operations Parameter Statement Section for details of the regular working hours, holidays and procedures for custodial overtime, etc.

D. Work cannot start in a particular Phase until students/staff have been relocated to the designated Swing Space (either in the existing building or in Temporary Buildings outside) or until there is an arrangement in place.
    1. Close coordination with the A/E, Program Manager, and the School Staff, will be required of the Contractor.

E. Some rooms within a Phase may be emptied of furniture, boxes, etc., while others may not be. This is dependent upon where the actual Swing Space will be located or any other arrangements required in the phasing plan. Protection of contents and contents moved by the contractor are the responsibility of the Contractor until work is completed.

F. The Contractor shall allow sufficient time to accommodate the Abatement Contractor's work. This activity shall be shown as a separate activity on the Construction Schedule. General Contractor shall coordinate the abatement scheduling with FBISD's selected Environmental Consultant and the Owner Representative.

G. Refer to Construction Documents for additional Phasing information.

1.9 HVAC AND WATER TREATMENT REQUIREMENTS Contractor will coordinate with FBISD for water treatment and HVAC maintenance. Please refer to the plumbing and mechanical specifications for the contractor's responsibilities related to these requirements.

1.10 PHASE ACCEPTANCE**.** Upon certification by the Contractor and recommendation of the A/E, FBISD will accept the Work of each individual phase as it is completed. Architectural acceptance shall be called "phase acceptance". The HVAC, electrical, plumbing and roofing systems will be accepted by FBISD when the entire project has been completed; at that point, upon completion of all relevant contractual requirements, Architect will issue substantial completion. The contractor will operate and maintain the HVAC, electrical and plumbing systems that are a part of his scope of work until substantial completion. The contractor's warranty for any new HVAC, electrical, plumbing and roofing systems shall commence at substantial completion for each school project, barring any deviations that have been pre-approved by owner's representative/FBISD. The contractor will install new filters and record date of replacement on each filter upon substantial completion.

1.11 USE OF TECHNOLOGY FOR PROJECT MANAGEMENT. FBISD will furnish information related to accessing web-enabled project management applications for this contract. FBISD and the owner's representative will implement project management software, Kahua, which will be easily accessible through the Internet. Contractor will cooperate with the owner's representative for the implementation and use of this tool.

Contractor will be required to create and post several types of documents into Kahua via the Internet. Request for Information (RFIs) will be posted by the Contractor and responded to by the A/E(s) in Kahua via the Internet, thereby facilitating communication among all parties and expediting resolution of issues. Any meeting minutes and field reports required to be created by the Contractor or A/E(s) will be posted to Kahua. FBISD and the Program Manager reserve the right to require additional documents to be entered into Kahua as shown below. Additional requirements may be identified.

Project Management Control System (PMCS) - Kahua

- The District and Owners Representative have agreed to use Kahua as the tool to manage projects between District, Owners Representative, and vendors (general contractors and architects).

- The following modules will be implemented:

    - Budget
    - Contracts
    - Invoices
    - Payments
    - Change Orders
    - Close Out
    - Issues
    - Meeting Minutes
    - Requests for Information

- Submittals
- Transmittals
- Field Details
- Field Work Directives
- Punch List
- Safety Notices

1.12 HAZARDOUS MATERIAL DESIGN AND CONSTRUCTION. FBISD has retained a separate environmental consultant to prepare contract documents including design drawings and specifications for the removal of hazardous materials from the schools and the air monitoring services (as applicable).

It shall be the responsibility of the Contractor to coordinate with the scheduled work performed by any of FBISD's separate Contractors including the hazardous materials abatement contractor. Contractor shall coordinate all aspects of the hazardous material abatement contractor's work with the Work under this Agreement. The Contractor shall always keep the Program Manager informed of all coordination issues with FBISD separate contractors. Other Contractor responsibilities in relation to the hazardous material design and construction coordination are per Article 6 of the General Contractor's Contract.

1.13 Permitting: Contractors are responsible for the costs of acquiring the building permits. The Contractor will obtain and pay for all trade permits and other miscellaneous permits that may be required by the City/County. Tap fees for connections to off-site water and sewer lines will be paid by unless specified differently by contract documents.

1.14 Storm Water Pollution Prevention Plan: Once the Notice to Proceed has been issued, the Contractor is obligated to comply with the applicable municipalities and applicable SWPPP codes and protocol. The Contractor assumes full responsibility for any complaints, citations, maintenance and complete management of the SWPPP plan including any and all documentation. For new schools with demolition scope by a separate contractor, Contractor shall coordinate with the separate contractor for a seamless transfer / transition of an existing SWPPP. Contractor will then submit all documentation to the District at closeout.

1.15 Construction Specification Index: All construction documentation will follow the 2016Construction Specification Index format.

1.16 The contractor shall tag locations of all equipment within the scope of work to comply with FBISD construction standards.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

3.1 USE OF PREMISES

A. Contractor shall coordinate work of all trades with assistance by owner's representative for all subcontractors or consultants retained by FBISD. Contractor shall sequence, coordinate, and perform the Work to impose

minimum hardship on the operation and use of the existing facilities and/or Project site. Contractor shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. Contractor shall confine entrance and exiting to the Project site and/or facilities to routes approved by the Owner.
C. Contractor shall secure building entrances, exits, and Work areas with locking devices as required by the Owner.
D. Contractor assumes custody and control of Owner property, both; fixed and portable, remaining in existing facilities vacated during the work.
E. Contractor shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the work, including Owner property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. Contractor shall protect areas adjacent to the Work in a similar manner. Prior to Owner occupancy, Contractor shall clean all surfaces including OWNER property.
F. Within existing facilities, the Owner will remove or request the contractor to remove portable equipment, furniture, and supplies from work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work.
G. Contractor is advised that school may be in session during performance of the work. Contractor shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the Owner, Contractor shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. Contractor shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. Contractor shall discontinue operation of equipment producing objectionable noise as required by the Owner.
H. Contractor shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.
I. Contractor shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.
J. Contractor shall not use or allow anyone other than Owner employees to use facility equipment, except in an emergency.

End of Section 01 10 00

PART 1 CERTIFICATION OF COMPLIANCE

1.1 REQUIREMENTS

A. Work related to this section “Certification of Compliance” is in accordance with Texas Government Code (411.0845), Texas Administrative Code (153.1101), Texas Education Code (22.0834 & 44.034), and Board Policy (CJA).

1.2 CRIMINAL HISTORY IN GENERAL

A. Before entering into a contract with the District, a person or business must give notice to the District if the person or an owner or operator of the business has been convicted of a felony. The District may terminate a contract with a person or business if the District determines that the person or business failed to give such notice or misrepresented the conduct resulting in the conviction.

PART 2 DEFINITIONS

A. ”Contracting entity” is an entity that contracts directly with the District to provide services to the District.

B. “Subcontracting entity” is an entity that contracts with another entity that is not a district to provide services to a school district.

C. “Direct contact with students” is the contact that results from activities that provide substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee.

1. Contact with students that results from services that do not provide substantial opportunity for unsupervised interaction with a student or students, such as addressing an assembly, officiating a sports contest, or judging an extracurricular event, is not, by itself, direct contact with students.
2. However, direct contact with students does result from any activity that provides substantial opportunity for unsupervised contact with students, which might include, without limitation, the provision of coaching, tutoring, or other services to students.

PART 3 EMPLOYMENT / CONTRACT

A. A person who, on or after January 1, 2008, is offered employment by an entity that contracts with the District or any subcontractor of the entity must submit to a national criminal history record information review if:

1. The employee or applicant has or will have continuing duties related to the contracted services; and
2. The employee or applicant has or will have direct contact with students.

B. An entity contracting with the District and any subcontractor of the entity shall obtain all criminal history record information that relates to a person described above through the criminal history clearinghouse as provided by Government Code 411.0845.

C. A contracting entity shall require that a subcontracting entity obtain all criminal history record information that relates to a person described above.

PART 4 CERTIFICATION TO DISTRICT

A. Contractor Certification
   1. The entity and any subcontractor of the entity shall certify to the District that it received all of the criminal history record information required above. The entity and any subcontractor of the entity shall also certify that it will take reasonable steps to ensure that the conditions or precautions that have resulted in a determination that any person is not a covered contract employee continue to exist throughout the time that the contracted services are provided.

B. Sub-Contractor Certification
   1. The subcontracting entity must certify to the District and the contracting entity that the subcontracting entity has obtained all criminal history record information that relates to an employee described above at EMPLOYMENT / CONTRACT, and has obtained similar written certifications from the subcontracting entity's sub-contractors.

C. Contractor and Sub-Contractor
   1. The contracting entity and any subcontractor of the entity shall provide the District, at its request, the information necessary for the District to obtain criminal history record information for all covered contract employees.

D. COMPLIANCE WITH REQUIREMENT
   1. The contracting entity complies with the requirements of this section if the contracting entity obtains a written statement from each sub-contracting entity certifying that the subcontracting entity has obtained the required criminal history record information for employees of the subcontracting entity and the subcontracting entity has obtained certification from each of the subcontracting entity's subcontractors.

E. DISQUALIFYING CONVICTION
   1. The contracting entity shall not permit a covered contract employee to provide services at the District if the employee has a disqualifying conviction under Texas Education Code 22.085.

PART 5 CRIMINAL HISTORY RECORD INFORMATION

5.1 Each person as described above (PART 3), performing work on site under this contract (including Contractors, Project Managers and/or Job Foreman) is required to obtain a background check through the DPS criminal history clearinghouse.

5.2 The Contractor shall pay all associated processing fees for this history and clearance.

5.3 The Contractor shall, prior to commencement of any work at the site. Certify that the firm has obtained, reviewed and verified the criminal history for each person

described above (PART 3).

5.4 The contractor shall, prior to commencement of any work at the site. Certify that no person described above (PART 3) have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

5.5 In addition the contractor shall, obtain from each Sub contractor, prior to commencement of any work at the site. Certify that the firm has obtained, reviewed and verified the criminal history for each person described above (PART 3).

5.6 In addition the contractor shall, obtain from each Sub contractor, prior to commencement of any work at the site. Certify that no person described above (PART 3) have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

5.7 The background checks shall remain confidential in a file located in the Contractors / Sub-Contractors possession.

5.8 The Contractor shall be advised that the background checks may take longer than a week to obtain from the Texas Department of Public Safety.

PART 6 ISSUANCE OF CLEARANCE IDENTIFICATION/ACCESS BADGES

6.1 Only after an individual criminal history has been obtained, reviewed and verified by the Contractor / Sub Contractor, a badge, hardhat emblem, or other visible identification identifier should be issued to the individual.

6.2 On request by the district, the Contractor / Sub Contractor must make available to law enforcement (District Police Department) a list off all persons that a criminal history has been obtained, reviewed and verified and that have been issued clearance identification/access badges for this project.

A. SUBMITTAL
   1. Submit sample Identifier for project record.

6.3 RESPONSIBILITY

A. All work and expenses required to obtain clearance identification/access badges or for other activities required in this section shall be borne by the Contractor as part of the Contract.

6.4 RULES AND REGULATIONS REGARDING IDENTIFICATION BADGES

1. Clearance identification/access badges provide access to the campus.
2. Any employee found on the campus without an -issued clearance identification/access badge will be escorted from the site and not be allowed to return until wearing a proper clearance identification/access badge.
3. All clearance identification/access badges are the property of the Contractor and must be immediately returned under the following conditions:
   a. Upon expiration; Upon separation of employment (for any reason);
   b. If convicted of, any disqualifying conviction under Texas Education Code 22.085

c. The Contractor shall immediately notify the District of personnel, Suppliers or Subcontractors whose work is terminated or completed and shall ensure badges are returned within 30 days of notification.

6.5 Escorting:

1. Any district staff, may escort any individual(s). THE ESCORT MUST REMAIN WITH THE INDIVIDUAL(S) BEING ESCORTED AT ALL TIMES WHILE ON THE SITE.
2. Escorts shall be limited to five (5) individuals, or less, depending on the circumstances to ensure positive control is maintained at all times.
3. A non-badged person can be escorted a maximum of five (5) times in a calendar year, starting the day of the first escort.

6.6 All badges that are lost, stolen, or otherwise unaccounted for must be immediately reported to the District.

6.7 Unsecured Doors: Contractors and their employees will be held accountable for doors located within their work sites that provide direct or indirect access to the campus. Doors that provide such access must NOT under ANY circumstances be left open and unattended. Individuals who have been issued Contractor badges are required to challenge any individual attempting unauthorized access to the campus.

6.8 Contractors requiring access through vehicle gates must make arrangements for access through the General Contractor/Campus.

PART 7 SPECIAL REQUIREMENTS

7.1 Each campus has specific access procedures which may include campus specific verification software and other visitor management requirements.

7.2 Coordinate and comply with each campus' requirements prior to start of work for their individual process.

PART 8 KEYS AND ACCESS CARD

8.1 Contractors that require keys and/or access card to perform work at the project site shall coordinate with the assigned FBISD Project Manager.

8.2 Keys should never be issued to Sub Contractors.

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PART 9 FORMS (attached for your use)

9.1 Certification of Criminal History Record Information Review by Contractor

9.2 Certification of Criminal History Record Information Review by Sub-Contractor

End of Section 01 14 13

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION REVIEW BY CONTRACTOR

Certifying Affidavit submitted to:

Name of School District: _____

Mailing Address: _____

_____

Project/Agreement: _____

STATE OF TEXAS §

COUNTY OF _____ §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to _____ Independent School District (the "District") that such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency, the criminal history record information of all employees of the contracting firm hired *before January 1, 2008*, who (i) have or will have continuing duties related to the contracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee). The undersigned further certifies that no employees of the contracting firm who meet the requirements of (i) and (ii) herein have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

(2) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to the District, that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees of the contracting firm hired *on or after January 1, 2008*, who (i) have or will have continuing duties related to the contracted services, and (ii) have or will have direct contact with students. The undersigned further certifies that no employees of the contracting firm, who meet the requirements of (i) and (ii) herein have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

(3) The undersigned firm swears and covenants that no present or future employee of the contracting firm, no present or future independent contractor, and no present or future employee or independent contractor of any subcontractor of the contracting firm, will provide services to the Project on a continuing basis that involve direct contact with students unless and until such employee's or independent contractor's national criminal history record information has been reviewed, cleared and certified, as required herein. In the event of an emergency, an employee or independent contractor who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District employee.

(4) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee or independent contractor of the contracting firm has been convicted of an offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy, the contracting firm will immediately remove or cause the removal of such employee from the Project or scope of the Agreement and notify the District.

_____, being duly sworn, affirms and certifies that he/she is the _____ (position) of _____ (contracting firm), and that all statements and acknowledgements contained herein are true and correct, and that he/she has the authority to bind such firm to the covenants set out above. _____

SUBSCRIBED AND SWORN TO BEFORE ME this ____ day of _____, 20_____.

Notary Public _____ State of _____

My Commission expires _____

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION REVIEW BY SUBCONTRACTOR

Certifying Affidavit submitted to:

Name of School District: _____

Mailing Address: _____

_____

Name of Contractor:_____

Mailing Address: _____

_____

Project/Agreement: _____

STATE OF TEXAS §

COUNTY OF _____ §

(1) The undersigned representative, on behalf of the subcontracting firm identified below, swears and affirms to _____ Independent School District (the "District") and to the Contractor identified above that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees of the subcontracting firm who (i) have or will have continuing duties related to the subcontracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee). The undersigned further certifies that no employees of the subcontracting firm who meet the requirements of (i) and (ii) herein have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

(2) The undersigned representative, on behalf of the subcontracting firm identified below, swears and covenants that no present or future employee of the subcontracting firm, no present or future independent contractor, and no present or future employee or independent contractor of any sub-subcontractor of the subcontracting firm, will provide services to the Project on a continuing basis that involve direct contact with students unless and until such employee's or independent contractor's national criminal history record information has been reviewed, cleared and certified as required herein. In the event of an emergency, an employee or independent contractor who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District employee.

(3) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee or independent contractor of the subcontracting firm has been convicted of an offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy, the subcontracting firm will immediately remove or cause the removal of such employee from the Project or scope of the Agreement and notify the District.

(4) The undersigned firm further certifies that it has obtained certifications from all subcontractors whose employees (i) have or will have continuing duties related to the subcontracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee), that such subcontractors have obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees of the subcontracting firm assigned to perform services to under the Project or Agreement, and that no employees have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

_____, being duly sworn, affirms and certifies that he/she is the _____ (position) of _____ (contracting firm), and that all statements and acknowledgements contained herein are true and correct, and that he/she has the authority to bind such firm to the covenants set out above.

_____

SUBSCRIBED AND SWORN TO BEFORE ME this ____ day of _____, 20_____.

Notary Public _____ State of _____

My Commission expires _____

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. Refer to the AIA A201 General Conditions and the Supplementary Conditions for additional requirements concerning allowances. If necessary additional requirements will be issued by Change Order (CO).

1. Allowances shall cover the cost to the Contractor of materials, all labor costs, and equipment delivered at the site, overhead, profit, bonds, insurance and all applicable taxes, less applicable trade discounts.
2. PCO (Potential Change Order) will be issued by the A/E via Kahua (Potential Change Order Module) to document and gain authorization to utilize allowance on a particular campus for items not covered in the original contract scope of work.
3. AEA (Allowance Expenditure Authorization) is used for authorization and tracking of use of contract allowances. A separate AEA series is used for each defined allowance.
4. Any needs beyond the means of the contract shall require Change Order(s).
5. CAEA (Contingency Allowance Expenditure Authorization) shall only be used for necessary work authorized by the District and in addition to the contracts defined scope of work or to credit work deleted from the contract as authorized by the District.
6. The contingency allowance (if provided) is not an entitlement to the GC. Unused portions shall be removed from the contract via a final Change Order during contract closure.
7. A CO is only used when no other funding sources are available within the contract and contract value must be increased.
8. A CO is the only method for adding funding or to change the contract work or time (when funding from the contingency allowance included in the Contract is depleted).Types of allowances include the following:
    a. Types of allowances include the following:
        i. Lump-sum allowances.
        ii. Unit-Cost allowances
        iii. Quantity allowances
        iv. Contingency allowances.
        v. CSI Division allowances

B. Related Sections:

1. Division 00 Competitive Sealed Proposal Form - Base Bid.
2. Division 01 Section "Unit Prices" for procedures for using unit prices.
3. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. Contractor shall advise Architect and owner's representative of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work. All specific allowance scope shall be included in the schedule provided by the contractor.
B. At Architect's or Program Manager's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
C. Once the proposal is approved by the Owner, purchase products and systems selected by the Architect.

1.4 SUBMITTALS

A. Submit proposals for approval of purchase of products or systems included in allowances, in the form specified for Contingency Allowance Expenditure Authorization (CAEA), Allowance Expenditure Authorization (AEA), or as specified in Change Order.
B. Submit all necessary backup per the contract requirements for approval of PCOs and AEAs.
C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Contingency Allowance Expenditure Authorization (CAEA) is a request for utilization of a specified portion of the contingency allowance included in the GC contract.
B. An Allowance Expenditure Authorization (AEA) is a request for utilization of a specified portion of an allowance included in the GC contract.
C. Each CAEA, AEA and CO must be listed separately on the schedule of values (SOV) in the pay application under the appropriate funding category or at the bottom of the SOV.

D. Change Orders (CO) are a request for utilization of a specific portion of contingency dollars outside the GC contract and it is used when no other funding sources are available within the contract.

End of Section 01 21 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Sections:

1. Division 00 Competitive Sealed Proposal Form – Alternates and Unit Pricing.
2. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Division 01 Section "Quality Requirements" for general testing and inspecting requirements

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract documents are either increased or decreased.

1.4 PROCEDURES

A. A Unit Price is a cost for a unit of work, as described in the Proposal Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark-up by the Contractor or his Subcontractors.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. If the quantities of the items listed in the Schedule of Unit Prices are increased, the Unit Prices set forth by the Contractor shall apply to such increased quantities. Unit Prices for adjusting the Contract Sum for less work or material installation will be 95% of these amounts.

PART 2 PART 2 - PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

End of Section 1 22 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by Proposers and stated on the Proposal Form for certain work defined in the Proposal Requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the total addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum. Pricing for alternates may not be submitted or listed in the form of an allowance amount on the proposal form.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
2. Cost listed for each Alternate includes cost of related coordination, modification or adjustment.

B. Notification: Immediately following award of the Contract, Contractor shall prepare and distribute to each entity or person to be involved in the performance of the Alternate Work, a notification of the status of each Alternate scheduled herein. Indicate which alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates if any.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Contractor shall be responsible for any changes in the Work affected by acceptance of Alternates. Claims for additional costs or time extensions resulting from changes to the Work as a result of the Owner's election of any or all Alternates will only be considered if it is a deferred for later consideration.

E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Refer to section 00 Competitive Sealed Proposal forms for Schedule of Alternates

End of Section 01 23 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
4. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor and Owner.

1.4 SUBMITTALS

A. Substitution Requests: General Contractor to submit a copy of each request for consideration to be reviewed by A/E and owner. Identify product or fabrication or installation method to be replaced. Include related Specification Section number and title, Drawing numbers and titles and complete documentation for substitution Include the following information with each request:

1. Certification by the Contractor to the effect that, in the Contractor’s opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated.
   a. Include in a certification the Contractor’s waiver of right to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, where applicable or requested.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated, where applicable or requested.
    i. Research reports evidencing compliance with building code in effect for Project, from IBC, where applicable or requested.
    j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    k. Cost information, including a proposal of change, if any, in the Contract Sum
3. Acceptance of substitutions will be delivered in writing by A/E, owner’s representative or owner. Upon acceptance contractor will follow Section 01 33 00 Submittal Procedures and/or CSI division specifications for accepted substitutions.
4. Substitutions may be considered only when specified product or material is no longer available in the market; or if the product or

material provides a better value to the Owner and is within, or less than the project budget.

5. This Substitution procedure is not allowed during the Procurement Phase.
6. During the Construction Phase, all substitutions proposed by the GC shall be approved in writing by the A/E and the Owner.
7. Approval: If necessary, Architect will request additional information or documentation for evaluation within a reasonable amount of time from receipt of a request for substitution. Architect will recommend to the owner's representative acceptance or rejection of proposed substitution within a reasonable amount of time from receipt of all required documentation. Owners' representative will recommend to the District acceptance or rejection of proposed substitution within a reasonable amount of time from receipt of all required documentation. Upon recommendation from the owner's representative, the District will provide acceptance or rejection of proposed substitution within a reasonable amount of time from receipt of all required documentation.
    a. Forms of Acceptance: Owner Provided Substitution Request Form, which can be attached to any of the following (as applicable): Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work with Design Manager and Owner written approval.
    b. Rejection will include a statement giving reason for rejection from AE or Owner's representative.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.
B. The Owner may not consider the request if the Contractor cannot provide the product or method because of failure to pursue work promptly or coordinate activities properly.

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

Approval process for both types of substitutions shall be as described above.

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
    1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return

requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

A. Substitutions for Convenience: Architect will consider requests for substitution if received within twenty (20) days after the Notice to Proceed. Requests received after that time may be considered or rejected at the discretion of Architect, only when there is an advantage to the Owner.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities that Owner may assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted via Owner provided Substitution Request Form.
e. Requested substitution may not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.

j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. System Substitution: No changes should be anticipated in major building system types or approved manufactures in pricing of schedule; the Owner has standardized materials in place in existing buildings, and will not change for the convenience of the contractor.

PART 3 - **EXECUTION (Not Used)**

PART 4- **FORMS (attached for your use)**

4.1 Substitution Request Form

End of Section 01 25 00

Substitution Request

(Must be submitted within 15 days after date of contract, unless special circumstances exist)

To: Carolina Fuzetti – Executive Director Design and Construction Date: _____

AE Firm: _____ Project Manager: _____

BP #: ____ Org No: _____ Project Name: _____

Submission #: _____ Contractor: _____

Project Type: ___ Addition ___ Renovation ___ New Construction

SUBSTITUTIONS MUST BE ORIGINATED BY CONTRACTOR & EVALUATED BY A/E / DESIGN AND CONSTRUCTION PRIOR TO SUBMITTAL TO BOND OFFICE.

Description of Substitution:

_____

Reasons for Request: (specified product no longer available, extended warranty, lower initial cost, reduced maintenance cost, better quality, available immediately, schedule improvement, other): _____

_____

_____

Credit due to District, if any: $_____.
Reduced Contract Time, if any: _____ days

Product Listing Schedule: (Attach any required documentation)

Related unit-of-work Specifications Section #	
Generic name as used in the Contract Documents	
Proprietary name, model number, and similar product designation	
Prime Contractor Name / Phone #	
Sub-Contractor Name / Phone #	
Rationale: (Why is change needed?)	
Features & Benefits: (What is the benefit to FBISD?)	

Potential Issues: (What are the drawbacks or negative impacts?)	
Construction Impact: (What is the potential impact to cost or schedule?)	
O&M Impacts: (What are the potential impacts to parts & labor maintenance cost, spare parts inventory, and current maintenance practices?)	
Utility Cost Impact: (What is the potential impact on electric, gas and water utility consumption and cost to FBISD?)	
Drawing #	

Contractor's Certification:
In the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal to or better than the work required by the Contract Documents, and it will perform adequately in the application indicated. The Contractor waives the rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.

_____

_____

General Contractor's or Representative Signature Date

	APPROVED	REJECTED	DATE	REASON
A/E's Recommendation (within 2 wks. of receipt)				
FBISD Facilities Recommendation				

Pending Information Noted below:

Final Response to Substitution Request: _____ Approved _____ Not Approved

_____

District Representative Date

_____

Project Manager Date

_____

Design Manager Date

Refer to Specifications Section 01 60 00 for additional provisions and GC Agreement 3.4.2.1 and 3.5.1.

A/E, PM and/or District are not authorized to waive any code requirements. If the Request is approved, when signed by the District and Project Manager and received by the Contractor, this document becomes effective immediately as a FBISD Approved substitution and the GC Firm shall proceed with the change(s) described above. If the Request is not approved, no changes can be implemented

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:

1. Changes to the Contract may involve close coordination between this Section and Section listed below. Retain Section in subparagraph below that contains requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS –

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

B. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change without Owner approval

C. Within time specified in Proposal Request or five (5) days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Include costs of labor and supervision directly attributable to the change.
4. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

D. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

A. The A/E will issue a work change proposal request using the district's program management information system (PMIS). A potential change order (PCO) will be issued in the PMIS under the PCO module. The contractor will upload all appropriate backup per the requirements in the AIA 201 under section 7. Upon execution of workflow and approval of the PCO the contractor will be provided approval via email or PMIS notification and work can begin. A CO will be issued at a later date to be agreed upon by A/E, contractor and owner's representative.
   1. Construction - PCOs: This category is used to capture any Potential Change anticipated during the life of the projects. All AEA's, CAEA's, and COs are initiated with a PCO as well as any potential item identified by the owner's representative that may end up being voided.
   2. PCOs Reports: Several Prolog Report are available. The categorization established allows reports to be provided for specific categories depending on the request or the audience.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

C. PROCESS:

1. CCDs will be issued by the A/E via Prolog (Potential Change Order Module) and the documents will be signed via DocuSign.
2. The Project Team will review the GC Construction Schedule for evidence of potential time impact to the Construction Schedule, contract or related contracts. The GC will be required to demonstrate that the change impacts specific critical activities in the overall schedule, and to what extent. Determination of impact to fees and other costs resulting from schedule delays to be provided to owner's representative and the District for review, approval or rejection.
3. The Project Team will conduct a CPM review, and may include preparation of independent fragment analysis where necessary to verify the criticality of the proposed changed work.
4. The PMT may produce a partial CPM schedule that displays any significant time impact of the proposed change for further analysis.
5. The PMT will keep these analyses confidential in a restricted access file.
6. The GC will be required to prepare recovery schedules to minimize delays.
7. Negotiations: The PM will schedule and coordinate the negotiation sessions. Attendees will include the GC, the representatives from the District, the PM and A/E.
8. The Negotiation Team will meet with the GC with the intent to negotiate an agreement. The number of negotiating sessions will be based on the complexity of the issues and the scope of the change.
9. If there is no agreement with the GC during negotiations, and it is determined that the Change is required, the A/E will prepare an AIA Form G714 Construction Change Directive (CCD).
10. If there is an agreement, the A/E will initiate a CO as appropriate.
11. The PM will monitor all CCDs and report the status to the District.
12. Document Control collects required signatures via DocuSign, ensures that files are saved electronically and files the original CCD in the hardcopy files.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

End of Section 01 26 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established within the General, Supplementary and Other Conditions of the Contract, Division 1 – General Requirements, and Drawings are collectively applicable to this Section.

1.2 REQUIREMENTS

A. By the 25th of the month, the Project Manager (PM), the Architect (A/E), and the General Contractor (GC) meet to conduct a quality control of the current month Payment Application with attachments.

B. The A/E and PM perform visual observations of the work in order to verify GC estimates of job progress, including verification of stored materials in bonded warehouses. The GC, PM and A/E meet to determine appropriate percentages of completion on all items on the Schedule of Values (SOV).

C. Upon agreement by the PM and A/E, the GC submits Payment Application (Pay App) in District approved format via Kahua, as per GC Agreement with all necessary supporting material. The GC includes any required back-up documents (PDF format) to substantiate work completed, at minimum: SOV, Monthly Schedule with baseline, SBE report.

D. The A/E reviews the pay application. If there is need for clarification or additional information, the A/E discusses with the GC and obtains the needed information. Upon approval, the A/E approves certifies the Pay Application (Pay App) and approves the workflow in Kahua and notifies PM (via workflow). If the Pay App is not approved, the A/E sends it back to the GC for resubmission.

E. The PM reviews the pay App. If not approved, sends back to GC for resubmission. If the workflow is approved, Kahua workflow notifies District's Design & Construction (D&C) Construction Manager for review.

F. D&C Construction Manager reviews and approves the Pay App in Kahua, notifies Controls Manager via Kahua workflow. If the Pay App is not approved, Construction Manager sends Pay App to PM for resubmission.

G. Controls Manager reviews and approves the Pay App in Kahua, notifies District's Design & Construction (D&C) Director. If the Pay App is not approved, Controls Manager sends Pay App to PM for resubmission.

H. The District's D&C Executive Director approves the Pay App in Kahua and notifies D&C Budget Accounting Associate (via workflow). If not approved, send Pay App to PM for resubmission.

I. D&C Accounting Associate reviews and inputs Pay App in PeopleSoft. If not approved send Pay App back to PM for resubmission. If approved send to District's accounting for processing.

J. District's Accounting processes payment to GC in People Soft and notifies GC. Checks are cut on Tuesdays and Thursdays and issued via Automated Clearing House (ACH) system for electronic checks transfer.

K. Wednesday and Friday the GC receives payment.

1.3 RELATED SECTIONS/DOCUMENTS

A. General Conditions: Progress Payment, and Final Payment.

B. Section 013300 – Shop Drawings, Product Data and Samples

C. Section 012973 – Schedule of Values
D. Section 013120 – Small Business Enterprise Procedure

1.4 FORMAT
A. AIA G702 – Application and Certificate for Payment
B. For continuation sheet, use AIA G703 in format at Section 012973 for schedule of values.

1.5 PREPARATION OF PAY APPLICATIONS
A. Type required information or use media printout.
B. Execute certification by authorized officer.
C. Use data on approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for products.
D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for original item of Work.
E. Prepare one application with a schedule of values for each school with a breakdown in the current CSI format. Payment Application format may be provided by the PM.
F. Each school shall have a separate schedule of values for Renovation Work and for Addition Work.

1.6 SUBMITTAL PROCEDURES
A. Schedule meeting (20) days prior to submitting first pay request, to review schedule with Architect and Project Manager.
B. Submit one (1) original copy of each Application for Payment at times stipulated in Agreement.
C. Submit Pay Application via Owners designated software (Kahua). Include with the submission:
1. G702, G703
2. SBE Utilization Report
3. Contractor Release of Liens
4. Sub-contractor Release of Liens
5. Projected Contractor Invoicing schedule (Cashflow) for the next 6 months
6. Updated construction schedule (complying with contract dates)
D. Payment Period: Submit at intervals stipulated in the Agreement.

1.7 SUBSTANTIATING DATA
A. When Architect requires substantiating information, submit data justifying line item amounts in questions. On Owner controlled allowance items, submit actual invoices from supplier of product or service.

1.8 FORMAT AND SUBMITTAL REQUIREMENTS
A. Set-up format and submittal requirements include but are not limited to the following:
1. Contractor must use AIA G702 and AIA G703 forms for Application for Payment or form provided by PM.
2. All values should be taken to the hundredth (dollar).
3. All items must be broken down by school, by addition/renovation (where applicable). This break down must

match the breakdown as specified in the GC Contract or established with the Program Manager.

4. All items must be organized by the current CSI division.
5. All items must be broken down by material and labor.
6. All applicable current CSI divisions must be sub-totaled.
7. Each addition/renovation (where applicable) and school must be sub-totaled.
8. The Owner's Contingency Allowance (O.C.A.) should occupy one line item at the bottom of each addition/renovation and match the amount specified in the GC contract. This line item should be separated from any other CSI division.
9. All other contract allowances (pre-bid or post-bid) should be specified per the GC contract.
10. General Conditions, P&P Bonds, Insurances, Fees, Building Permits, Mobilization, and De-mobilization must be identified.

B. Post-set-up format and submittal requirements include but are not limited to the following:

1. Contractor may not change the "scheduled values" after approval of the Schedule of Values (SOV) by the A/E, PM, and FBISD (at first Application for Payment).
2. Include FBISD P.O. number on AIA G702.
3. Include FBISD P.O. number in application number. For example, "222123-3" would be the third Application for Payment for P.O. 222123.
4. Certified by A/E.
5. Previous invoice totals match previous invoice.
6. Attach an SBE Pay Sub Contractor/Sub Consultant Utilization Report, signed or acknowledged by e-mail or waiver by all SBE subcontractors. (Acknowledgment must include amount paid during current period.)
7. Attach an SBE Pay Sub Contractor/Sub Consultant / Suppliers Payment Certification Form, signed or acknowledged by e-mail or waiver by all SBE subcontractors. (Acknowledgment must include amount paid during current period.)
8. Attach a schedule for each project, updated for the billing period, with Substantial Completion dates per GC contract or applicable CO.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

End of Section 01 29 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established within the General, Supplementary and Other Conditions of the Contract, Division 01 – General Requirements, and the Drawings are collectively applicable to this Section.

1.2 REQUIREMENTS INCLUDED

A. Procedures for preparation and submittal of Schedule of Values (SOV).

1.3 RELATED SECTIONS/DOCUMENTS

A. General Conditions.
B. Section 01 29 00 – Payment Procedures.

1.4 FORMAT

A. Print SOV on AIA Documents G703 – Continuation Sheet for Application and Certificate for Payment.
B. Follow Table of Contents of Project Manual for listing components parts. Identify each line item by number and title of major Specifications Section.

1.5 CONTENT

A. Using the current Master Format™ Edition, in CSI format, each school shall have a separate SOV for Renovation Work and for Addition Work, as applicable.
B. In CSI format, list installed value of each major item of Work to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar. All values should be taken to the Dollar.
C. List Owner Controlled Contingency Allowance and other allowances with the specified monetary amount for each allowance in separate divisions.
D. Contractor to use separate lines for bonds, insurance, temporary facilities and controls, superintendents, mobilization, and demobilization. Each item shall include prorated portion of overhead and profit.
E. Provide line item for safety on the SOV.
F. Provide line item for closeout on the SOV.
G. The sum of the values listed shall equal total Contract Sum.

1.6 SUBMITTAL

A. GC prepares and submits a SOV timely prior to the submittal of the first pay application and that the A/E and PMT reviews and responds prior to the approval of the first pay application.
B. Upon resolution of issues, the PM is responsible for providing a letter accepting the SOV.
C. Payment against the approved SOV is based on earned value which is derived from the status of the construction as observed by the A/E and PM.
D. Submit a copy via Kahua transmittal of the SOV within ten (10) days of award of contract and prior to Pre-Construction Meeting or first pay application.
E. Identify Project by title and number.

F. Secure the A/E and owner's representative (PM) approval of the SOV prior to submitting the first Pay Application.
G. The activities on the SOV are to reflect construction by area or phase.
H. Breakdown all costs into equipment, materials, and labor.

1.7 SUBSTANTIATING DATA

A. When the A/E or the PM requires substantiating information, submit data justifying line item amounts in question.
B. Provide one (1) copy of data with cover letter for each copy of Pay Application. Show Pay Application number and date and line item by number and description.

PART 2 PRODUCTS (Not Applicable)

PART 3 PART 3 – EXECUTION (Not Applicable)

End of Section – 01 29 73

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, specifications, and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Requests for Information (RFIs).
   4. Project meetings.
   5. Closeout Procedures

B. Related Sections:
   1. Division 01 Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division 01 Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.

8. Startup and commissioning of systems.

1.5 KEY PERSONNEL

A. Key Personnel Names: Within ten (10) days following Notice to Proceed, submit a list of key personnel per submittal procedures in 01 33 00, including superintendent and other personnel in attendance at Project site. Identify individuals; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses.
    1. Post copies of list in project meeting room, in temporary field office, in construction safety manual, and provide copies electronically to AE, owner's representative or others upon request. Keep list current at all times.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified using the Program Manager's electronic project management software.
    1. Architects will respond to RFIs that are initiated by the contractor and not by other entities controlled by Contractor.
    2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
    3. Contractor uses the RFI to request direction and/or clarification resulting from, but not limited to the following:
        a. Conflicts, omissions, ambiguities, or discrepancies within the Contract Documents
        b. Conflicts between the Contract Documents and any provision of code or regulation applicable to the performance of the work
        c. Conflicts between the Contract Documents and any standard specification or instruction of a manufacturer
        d. Conflicts with differing existing conditions.
B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
    1. Project name.
    2. Project number.
    3. Date.
    4. Name of Contractor.
    5. Name of Architect.
    6. RFI number, numbered sequentially.
    7. RFI subject.
    8. Specification Section number and title and related paragraphs, as appropriate.
    9. Drawing number and detail references, as appropriate.
    10. Field dimensions and conditions, as appropriate.
    11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor’s signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form generated using Owner’s designated software with substantially the same content as indicated above.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received on the following working day.
    1. The following RFIs will be returned without action:
        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for coordination information already indicated in the Contract Documents.
        d. Requests for adjustments in the Contract Time or the Contract Sum.
        e. Requests for interpretation of Architect's actions on submittals.
        f. Incomplete RFIs or inaccurately prepared RFIs.
    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
        a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing via the owner’s designated software within seven (7) days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit on a weekly basis a log of RFI’s organized by the RFI number. The log should be generated using the Owner’s designated software.

1.7 PROJECT MEETINGS

A. Preconstruction Conference: Architect and Project Manager will schedule and conduct a preconstruction conference at the earliest possible date after the execution of the Agreement and before starting construction, at a time convenient to Owner, PM and Architect.

1. Purpose of the conference will be to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, PM, Architect, and their consultants; Contractor and its superintendent; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including any or all of the following:

    a. Introductions
    b. Submission of Post Proposal Information if any outstanding
    c. Tentative Construction schedule.
    d. Meetings: dates, locations, attendees, types, agendas
    e. Communication: Owner's representative electronic project management software, correspondence flow
        1) Lines of communications
    f. Schedule:
        1) Phasing
        2) Critical work sequencing and long-lead items
    g. Designation of key personnel and their duties
    h. Procedures for processing field decisions and Change Orders
    i. Procedures for RFIs
    j. Consultant / Lab Notification Requirements
        1) HazMat
        2) Roofing
        3) Envelope
        4) Test & Balance
        5) Materials Testing
        6) Commissioning
        7) Other Inspections as applicable.
    k. Procedures for processing Applications for Payment
        1) AIA G702 and G703 (Schedule of Values)
        2) Cash flow
        3) Updated Schedule
        4) AE Review
        5) SBE
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Preparation of record documents.
    o. Use of the premises and existing building
    p. Work restrictions.
    q. Working hours.
    r. Owner's occupancy requirements.
    s. Responsibility for temporary facilities and controls.

1) Site access
2) Signage
3) Dumpsters
4) Fencing
5) SWPPP
6) Parking availability
7) Office, work and storage areas
8) Equipment deliveries and priorities

t. Procedures for disruptions and shutdowns.
u. Safety
1) Emergency Contact List
2) First aid.
3) Site Security.
v. Progress cleaning.

4. Minutes: Architect will record and distribute meeting minutes using the Program Manager's electronic project management software.

B. Progress Meetings: The architect and the Project Manager will schedule and administer progress meetings at weekly intervals.
1. Contractor shall make physical arrangements at site for the progress meetings.
2. Location of meetings: Contractor's field office, unless agreed upon mutually by the Architect, Contractor and PM.
a. Determine at the Pre-construction Meeting if space in the existing facility or facilities is available for meetings.
b. For multiple school Bid Packages, weekly progress meetings will be held at each school site on a rotating basis. Site specific meetings will be held at the discretion of the PM.
3. AE will prepare agenda, distribute notice of the meeting, PM will preside at meetings. AE will record minutes and distribute copies within five (5) days after meeting to participants, and to entities affected by decisions at meetings. Distribution will come from owner's software or email.
4. Coordinate dates of meetings with preparation of payment requests.
5. Attendees:
In addition to representatives of Owner, Owner's representative, Professional Consultants, as appropriate to the agenda, and Architect, each contractor, job superintendent, subcontractor, supplier, and other entities as appropriate to the agenda shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
6. Agenda will contain some or all of the content below:
a. Review and correct or approve minutes of previous progress meeting.
b. Review other items of significance that could affect progress.

Include topics for discussion as appropriate to status of Project.

1) Safety (lost time, accidents, violations, etc.)
2) Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time including PCOs.
    a) Review schedule for next period.
3) New Business (Field observations, problems, decision, identification of problems which impeded planned progress, non-confirming work, etc.)
4) RFI's and RFI log review
5) Submittals and submittal log review
6) PCOs, CAEAs and related log reviews
7) Review of draft Application for Payment, as necessary.
8) For new schools: LEED Certification status and strategy.

c. Review present and future needs of each entity present, including the following:
    1) Interface requirements.
    2) Sequence of operations.
    3) Access.
    4) Site utilization.
    5) Temporary facilities and controls.
    6) Progress cleaning.
    7) Quality and work standards.
    8) Status of correction of deficient items.
    9) Field observations.
    10) Pending claims and disputes.

7. Minutes: Using the Owner's designated software, the entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
    1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations

that have preceded or will follow, shall attend the meeting. Advise Owner, PM, and Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
   a. Contract Documents.
   b. Related RFIs.
   c. Submittals.
   d. Review of mock-ups.
   e. Possible conflicts.
   f. Compatibility problems.
   g. Time schedules.
   h. Weather limitations.
   i. Manufacturer's written recommendations.
   j. Warranty requirements.
   k. Compatibility of materials.
   l. Acceptability of substrates.
   m. Space and access limitations.
   n. Testing and inspecting requirements.
   o. Installation procedures.
   p. Coordination with other work.
   q. Required performance results.
   r. Protection of adjacent work.
   s. Protection of construction and personnel.
   t. For new schools: LEED Certification status and strategy.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. The meeting minutes will be documented by the GC.
4. Reporting: GC shall distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Reinstallation Conference: When required in individual Specification Sections, convene a reinstallation conference at work site prior to commencing work of the section.
   1. Require attendance of entities directly affecting or affected by Work of the Section.
   2. Notify Owner, PM and Architect at least seven (7) days in advance of meeting date.
   3. GC shall prepare agenda, preside at conference, record minutes, and distribute copies within five (5) days after conference to participants.
   4. Review conditions of reinstallation, preparation and installation procedures, and coordination with related work.

E. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner, Owner’s representative and

Architect, but no later than thirty (30) days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's representative, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following: Preparation of record documents.
    a. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    b. Submittal of written warranties.
    c. Requirements for preparing operations and maintenance data.
    d. Requirements for demonstration and training.
    e. Preparation of Contractor's punch list.
    f. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    g. Submittal procedures.
    h. Responsibility for removing temporary facilities and controls.
    i. Review of General Contractor Close Out Checklist (see Part 3 – Execution)
    j. Commissioning
    k. Testing and Balancing.
4. Minutes: Architect will record and distribute meeting minutes using the Owner's designated software.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 The General Contractor Close-out checklist will be completed by the owner's representative, architect, and general contractor. A copy will be submitted with the substantial completion AIA G704 and the certificate of final completion. The checklist can be found under section 01 77 00.

End of Section 01 31 00

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.

1.2 RELATED REQUIREMENTS

A. Section 01 32 16: Construction Schedule.
B. Section 01 33 00: Submittal Procedures.
C. Section 01 45 23: Test and Balance and Commissioning for HVAC.
D. Section 01 77 00: Contract Closeout.

PART 2 PRODUCTS (Not used)

PART 3 EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate operations included in various sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:
   1. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
   3. Provide provisions to accommodate items scheduled for later installation.
   4. Prepare and administer provisions for coordination drawings.
B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required in notices, reports, attendance at meetings, and:
   1. Prepare similar memoranda for Owner and Separate Work Contract where coordination of their Work is required.
C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, following:
   1. Preparation of schedules.
   2. Installation, relocation, and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project closeout activities.

D. Conservation: Coordinate Work operations to assure operations are carried out with consideration given to conservation of energy, water, materials, and:
    1. Salvage materials and equipment involved in performance of, but not actually incorporated into Work.

3.2 SUBMITTALS

A. Coordination Drawings: Contractor shall prepare coordination drawings to coordinate the installation of products and materials fabricated, furnished and installed by separate entities, under different parts of the Contract. Contractor shall notify Owner and Architect of all major conflicts in writing in a timely manner so that the design team can respond without construction delays. Coordination drawings shall address the following at a minimum:
    1. Limitations in available space for installation or service. Contractor shall overlay plans of each trade and verify space requirements and conflicts between trades. Minor changes and adjustments that do not affect design intent shall be made by Contractor and shall be highlighted for Architect's review.
    2. Incompatibility between items provided under different trades (such as difference in voltage between equipment specified under Divisions)
    3. Inconsistencies between drawings, specifications and codes (between trades and within each trade).
    4. Additional items required for existing facilities construction projects shall be designed and prepared from available as-built drawings that are verified through non-invasive and non-destructive, visual observation only. Contractor shall field verify actual existing conditions during and upon completion of demolition work and incorporate findings into preparation of co-ordination drawings. Minor changes and adjustments that do not affect design intent shall be made by Sub-Contractor and shall be highlighted for Owner and Architect's reviews.
B. Prepare coordination drawings in CAD with each trade on a separate layer, in specified color and scale. Contractor and each Subcontractor shall provide and forward reproducible copies and CAD drawing files in the order described here:
    1. Structural shop drawings shall indicate location and sizes of columns, beams and other structural members, as well as wall, roof and slab penetrations, and will be provided to mechanical, electrical, low voltage and plumbing Sub-contractors for co-ordination. Structural items shall be indicated using black lines.
    2. HVAC Subcontractor will indicate all ductwork, piping and equipment complete with installation and dimensioned service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger and support locations. Minor changes and adjustments that do not affect design intent shall be made by Subcontractor and shall be

highlighted for Owner and Architect's reviews. Forward drawings to plumbing, electrical and low voltage Subcontractor for further coordination. HVAC items shall be indicated using orange lines.

3. Plumbing Subcontractor will indicate all plumbing lines, and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger/support locations. Coordinate with HVAC Subcontractor. Minor changes and adjustments that do not affect design intent shall be made by Sub-contractor and shall be highlighted for Owner and Architect's reviews upon completion drawings shall be forwarded to Fire Sprinkler Subcontractor for further coordination. All Plumbing items shall be indicated using blue lines.
4. Fire Sprinkler Subcontractor will indicate fire sprinkler piping and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger or support locations. Coordinate with Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for Owner and Architect's reviews. Upon completion drawings shall be forwarded to Electrical and Low Voltage Contractor for further coordination. Fire sprinkler equipment shall be indicated using red lines.
5. Electrical and Low Voltage Subcontractors will indicate service and feeder conduit runs and other electrical equipment complete, including low voltage with installation and dimensioned service clearances, sizes, top or bottom of conduit and rack elevations, distances of conduits and equipment from building reference points and hanger and support locations. Coordinate with Fire Sprinkler, Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for Owner and Architect's reviews. Upon completion drawings shall be forwarded to Contractor for further coordination. Electrical work shall be indicated in dark green lines. Low voltage work shall be indicated in light green lines.
6. Contractor will be responsible for the overall coordination review. As each coordination drawing is completed, Contractor will meet with Owner to review and resolve all conflicts on coordination drawings.
7. Coordination meetings will be held in Project field office of Contractor. Contractor is required to distribute Shop Drawings, cut sheets and submittals to Subcontractors where appropriate. Reviewed coordination drawings will be maintained in Project field office of Contractor. Meeting minutes shall be developed by Contractor and submitted to Owner within 5 days.

8. GC will provide coordination effort for Owner provided consultants (included, but not limited to, Material Testing, Roofing Commissioning, Testing and Balancing) to ensure that activities meet contractual and schedule requirements.

End of Section 01 31 13

Fort Bend Independent School District

Small Business Enterprise Program Procedures
Spring 2023

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I. SUMMARY OF FORT BEND INDEPENDENT SCHOOL DISTRICT'S SMALL BUSINESS ENTERPRISE PROGRAM

Fort Bend Independent School District's Small Business Enterprise Program ("SBEP" or the "Program") was created to provide increased business opportunities for locally certified small businesses to participate in contracting and procurement at Fort Bend Independent School District (FBISD).

Shown below are the key features of the Program.

- The SBEP is a goal-oriented program, requiring contractors to whom FBISD awards prime contracts for design services or construction services to use "Good Faith Efforts" to utilize certified small businesses.

- The Program applies only to SBEP Eligible contracts, defined as all contracts for architectural design services, engineering design services or construction services valued at $50,000 or greater, except contracts for sole-source items, federally funded contracts, contracts with other governmental entities, and those contracts that are other- wise prohibited by applicable law or expressly exempted by FBISD. The SBEP shall not apply to contracts for goods and non-construction services.

- The SBEP is a race and gender-neutral program.

- FBISD has set an annual SBEP participation goal of twenty-five (25%) percent of the dollar amount of all SBEP-Eligible contracts. FBISD recognizes that individual actual participation may vary based on subcontracting opportunities, availability of small businesses, and price competitiveness. The participation goal may change from year to year based on all relevant factors considered.

- To participate, small businesses must be certified by an agency or organization whose certification is recognized by FBISD. Certification is based on the firm's gross revenues or number of employees averaged over the past five years, inclusive of any affiliates as defined by 13 C.F.R. § 121.103, does not exceed the size standards as defined pursuant to Section 3 of the Small Business Act and 13 C.F.R. § 121.201.

- The U.S. Small Business Administration-SBA.gov website Qualifying as a Small Business.

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The Small Business Enterprise Program provides benefits to the small business including:

- Providing assistance to small businesses, by providing information and support.
- Assisting small businesses by offering training and information regarding insurance and surety bonding.
- Requiring prospective vendors to provide written assurance of small business participation in their proposals for SBEP Eligible contracts.
- Providing workshops on issues frequently encountered by small businesses during the proposal process and generally while performing work at FBISD.
- Maintaining an updated small business directory and source list(s) to help identify qualified and available small businesses; providing information on the FBISD website about opportunities to do business with FBISD.
- Providing information on the FBISD website about SBEP Eligible procurements.

II. OPERATIONAL PROCEDURES

The procedures herein are established to govern the program components of the SBEP, including, without limitation, program compliance, certification, specific implementation measures, small business status verification, and reporting of small business participation.

A. SCOPE

These procedures apply to all FBISD Departments, architectural/engineering firms, and general contractors performing work on SBEP Eligible contracts, and all certified Small Business Enterprises. These procedures apply to those SBEP-Eligible contracts as defined herein.

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B. OVERALL ANNUAL SBEP GOAL

1. An overall annual goal for small business participation in architectural design services, engineering design services, and construction services at FBISD is set at twenty-five (25%) percent of the dollar amount of all SBEP-Eligible contracts.

   FBISD staff shall provide updates/reports, when needed, to the FBISD Board of Trustees calculating small business utilization.

2. An SBEP-Eligible contract may otherwise be exempt from a small business goal if it is determined that one or more of the following is present:

   a. A public or administrative emergency exists that requires the goods or services to be provided with unusual immediacy; or

   b. The goods or services requested are of such a specialized, technical, or unique nature as to require FBISD to be able to select its contractor without application of small business provisions; or

   c. The application of small business provisions would impose an unwarranted economic burden or risk on FBISD, would unduly delay acquisition of the labor, goods or services, or would otherwise not be in the best interest of FBISD; or

   d. The possible small business participation level based on small business availability would produce negligible or no small business participation.

   All SBEP exemptions must be approved by an authorized FBISD representative.

C. PROGRAM ACTIVITIES AND RESPONSIBILITIES

In an effort to maximize the Program's activities, the following procedures are in place to maximize opportunities for small business participation:

1. FBISD has designated the Small Business Enterprise Program Coordinator to implement the District's structured small business program under the direction of the FBISD Design and Construction Department.
2. FBISD may designate staff members to act as advisors and to work directly with small businesses and contractors to provide information, assistance, and support. FBISD's Small Business Enterprise Program Coordinator and/or staff will undertake various tasks to make the Program workable, including the following:

   - Coordinate workshops and/or training sessions for small businesses on challenges frequently encountered by small businesses during the proposal process and generally when performing work for FBISD;

- In coordination with the Purchasing Department, provide specifications and requests for proposals to the small business community in a timely manner, to allow small businesses adequate opportunity to develop responsible and responsive quotations and proposals;
- Enhance the FBISD database to identify SBEP-Certified Small Businesses and assist Contractors in identifying SBEP-Certified Small Businesses with which to subcontract;
- Participate in pre-proposal seminars, when needed, to explain small business requirements, including explanation of the forms that must be submitted with a proposal;
- Coordinate outreach activities for small businesses to ensure access and opportunity to compete;
- Conduct internal information sessions to inform and acquaint FBISD staff with the goals and objectives of the SBEP and to sensitize them to the problems of small businesses;
- Maintain lists of SBEP-Certified Small Businesses and coordinate with listings from other agencies, e.g., Port of Houston Authority SBE Certification, Metropolitan Transit Authority of Harris County (METRO) SBE Certification, and City of Houston SBE Certification. These lists will be offered to contractors and FBISD staff to assist in program implementation;
- Maintain records showing specific efforts to identify and award Contracts to small businesses and establish a monitoring system to ensure that all Contractors, Subcontractors, consultants, and vendors comply with Contract specifications related to small business enterprise utilization;
- Maintain and update the FBISD website on the SBEP proposals and on other opportunities to do business with FBISD; and
- In coordination with the Purchasing Department, inform small businesses of proposal notices and specifications related to their capabilities by placing proposal notices in the appropriate trade bulletins, local newspapers, and other periodicals and informing local trade associations, technical assistance agencies, economic development groups, and small businesses with capabilities relevant to the proposal.

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3. FBISD shall update the website to assist small businesses and Contractors. The website will contain the following:

   - Procedures outlining specific steps regarding how to submit a proposal;
   - Prerequisites for submitting proposals on contracts;
   - Information regarding how plans and specifications can be obtained;
   - Names of persons to contact concerning questions on proposal documents; and
   - Names of Procurement officers and office hours

4. FBISD will maintain and have available an updated small business directory and source list(s) per proposal solicitation to facilitate identifying small businesses with capabilities relevant to general contracting requirements and to particular solicitations. FBISD will make the directory and source list(s) available to contractors to assist their efforts to meet the small business requirements.

D. PURCHASING METHODS

Purchasing methods used by FBISD for construction services may include Competitive Sealed Proposals, Design-Build, Construction Manager-at-Risk, Construction-Manager -Agent and Job Order Contracting. In deciding which purchasing method to utilize, FBISD will determine which purchasing method provides the best value to FBISD, in accordance with the law and Board Policy.

Offeror's who tender a Statement of Qualifications response are required to provide evidence of their intent and ability to fulfill the goals of the Small Business Enterprise Program.

NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED HEREIN, NO CONTRACTOR OR ANY OTHER PERSON OR FIRM IS INTENDED TO OR SHALL DERIVE ANY LEGAL OR EQUITABLE RIGHTS, DIRECTLY OR AS A THIRD PARTY BENEFICIARY, FROM FBISD'S SBEP. NOTHING IN THE SBEP SHOULD BE CONSTRUED TO GIVE A CONTRACTOR OR SUBCONTRACTOR A PROPERTY INTEREST IN A BID, PROPOSAL OR CONTRACT PRIOR TO THE FBISD BOARD OF TRUSTEES' AWARD OF THE CONTRACT AND COMPLIANCE WITH ALL STATUTORY AND OTHER LEGAL REQUIREMENTS.

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E. CERTIFICATION PROCEDURES

Fort Bend Independent School District's SBEP requires prior certification of a small business in order to count the participation of that small business toward program goals.

1. Eligibility Requirements for Certification
   To be eligible for certification as a small business, each applicant must do the following:

   - Demonstrate that the firm's gross revenues or number of employees averaged over the past five years, inclusive of any affiliates as defined by 13 C.F.R. § 121.103, does not exceed the size standards as defined pursuant to Section 3 of the Small Business Act and 13 C.F.R. § 121.201;
   - Complete an SBEP application form for one of the FBISD approved certifying agencies.
   - Obtain certification from one of the FBISD recognized certifying agencies.

2. Certification Process

   a. To be eligible to participate in the SBEP, a small business must have certification of its small business status. Certifications may be obtained from public and private agencies that certify small businesses. FBISD does not represent that any particular agency employs the same definition of "small business" as that used by FBISD. It is the responsibility of the applicant to choose an agency for certification that uses FBISD's definitional criteria for small business.

      FBISD recognizes certification by the following agencies:
      Port of Houston Authority SBE Certification;
      Metropolitan Transit Authority of Harris County (METRO) SBE Certification;
      City of Houston SBE Certification; and
      Small Business Administration–SBA 8a (if authorized by the District for a procurement)

FBISD has the right to revoke acceptance of a business as a certified or qualifying small business and to conduct certification reviews in accordance with these Procedures. If a small business experiences any change in its certification status with its certifying agency (i.e. amendments, decertification, termination, graduation), the small business shall immediately notify FBISD of such change.

When an SBE certificate expires, a notification will be generated and submitted to the business. The business should obtain recertification through one of the certifying agencies accepted by FBISD, and forward the recertification certificate to the FBISD Small Business office within 10 business days.

3. Recertification Requirement
   A small business application is valid through the certification date provided by the certifying agency. To reapply, a business must submit a renewal application and evidence of continuing eligibility and certification to the FBISD certifying agency.

4. Revocation
   FBISD may revoke a previously approved application if it determines that the business does not meet the definition of a small business, or if the business fails to provide requested information in connection with an application review conducted by FBISD. A business may be disqualified from participation in the SBEP if the business fails to provide evidence of certification to FBISD. FBISD may also revoke a previously approved application if it determines that the small business is operating as a pass-through business or a non-small business affiliate. If a question arises regarding certification, FBISD will continue to count the previously certified small business as a SBEP Certified Small Business until the business's small business certification expires or is officially revoked.

5. Certification Reviews
   FBISD may conduct random certification reviews of certified businesses by auditing them to verify that the information submitted by the business is accurate and that the business remains eligible after certification has been granted. An application approval is subject to revocation if it is determined that a business does not qualify as a SBEP Certified Small Business under the terms of this Program. Certification reviews maybe conducted for any business that FBISD determines a certification review is warranted.

6. Limitations
   Notwithstanding any other provision of this Program, except upon a finding of good cause by FBISD, a firm shall be eligible to participate in the program until it can no longer qualify for reasons of growth or change in status.

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F. PROCEDURES FOR DETERMINING SATISFACTION OF GOOD FAITH EFFORTS REQUIREMENT

1. Each bidder, proposer, or respondent (hereinafter collectively referred to as "Proposer") must acknowledge FBISD's Non-Discrimination and Harassment Policy, which will be published in all solicitation documents. Said acknowledgment must include a statement evidencing the Proposer's awareness of FBISD's policy of nondiscrimination and affirmatively state that the Proposer has not and will not discriminate against any person or company on the basis of age, color, ethnic background, disability, family status, gender, national origin, race, religion, sex, sexual orientation, or veteran status in its participation in any aspect of the SBEP.

2. The Proposer must submit a Contractor's Small Business Plan (the "Plan") setting out how the SBEP goal for the proposed project is to be met. The Plan is to be submitted with the proposal response or within a period designated within the solicitation document, or upon notification of finalist or successful Proposer status. The Plan should be a simple, short statement of small business participation in the SBEP Eligible Contract. The Plan must include a list of SBEP Certified Small Businesses proposed as Subcontractors and suppliers. All small businesses listed must be approved as SBEP Certified Small Businesses by FBISD.

   The Plan must also include an SBE Participation Report for all listed small businesses, including the name of each small business, description of the scope of work to be performed, and the dollar value and percentage amount for each small business Contract.

   Agreements between a Proposer and a small business in which the small business promises not to provide subcontracting quotations to other Proposers shall be prohibited.

3. The Proposer shall adhere to the Plan submitted unless a waiver is received from the Small Business Enterprise Program Coordinator or FBISD authorized representative.

4. If the Proposer is unable to meet the SBEP goal, the Proposer must submit documentation of Good Faith Efforts to meet the small business participation goal. Such documentation shall be presented to the Small Business Enterprise Program Coordinator for review.

5. FBISD may consider future procurements, if a contractor failed to make Good Faith Efforts to meet the contract small business participation goal.

G. PROCEDURES FOR EVALUATING SMALL BUSINESS PARTICIPATION

Prior to any consideration of a bid or proposal for contract award, FBISD staff shall review submitted bids and proposals for verification of SBEP participation.

The staff evaluation process may utilize a point system based on evaluation criteria set forth in the procurement methods. A designated number of points will be set aside for small business participation, if applicable. Proposers may receive none, some, or all of the designated small business participation points, based on the Proposer's plan to satisfy small business participation goals. If, in the opinion of FBISD staff, the Proposer's response completely meets the stated small business participation goals, the total amount of eligible points will be awarded for small business participation.

The following is a sample point distribution sliding scale to be included in solicitation documents. FBISD reserves the right to adjust the sliding scale values published in a given solicitation, as deemed in the best interest of FBISD for that particular solicitation.

Proposed SBE Subcontracting Goal	Available Points
Less than 5%	0
5% - 9%	1
10% - 14%	2
15% - 19%	3
20% - 24%	4
25% or more	5

Points shall be awarded in accordance with the Proposer's response based on the architectural firm, engineering firm, or general contractor's commitment to small business subcontracting stated in the solicitation document and the point distribution sliding scale.

If the Proposer itself is a Certified Small Business who plans to self-perform work, the value of such self-performed work shall be included in calculating the eligible points for small business participation to the Certified Small Business Proposer, in addition to the value of work subcontracted to another small business.

If the Proposer itself is not a Certified Small Business, but has joint-ventured with another Certified Small Business, only the value of work to be self-performed by the Certified Small Business architectural firm, engineering firm, or general contractor will be included in calculating the eligible points for small business participation to the Small Business Proposer/joint venture, in addition to the value of work subcontracted to another small business.

H. PROCEDURES FOR REPORTING SMALL BUSINESS PARTICIPATION

1. Once the contract is awarded, the following guidelines should be utilized to report small business participation in the awarded contract, as the measure of its progress in meeting SBEP goals:

    a. If the small business is a subcontractor, FBISD will count toward applicable small business goals the portion of the total dollar value of a contract that is subcontracted to the small business.

    b. If the small business subcontractor is a part of a joint venture, FBISD will count toward applicable small business goals a portion of the total dollar value of a contract with an SBEP-eligible joint venture equal to the percentage of the ownership of the small business partner in the joint venture, or the participation of the small business partner in the contract.

    c. If the solicitation contemplates the use of small business subcontractors and a small business is the prime contractor, FBISD may require the prime contractor small business to utilize other small businesses as subcontractors, and count toward applicable small business goals as provided below.

    d. If the solicitation contemplates the use of small business subcontractors and a small business is the firm or general contractor, FBISD will count small business participation in two separate ways as follows:

        i. FBISD will count the total dollar value of the contract awarded to the SBEP eligible firm or general contractor toward applicable small business goals if the firm or general contractor small business performs 100% of the work itself or subcontracts with other SBEP Certified Small Businesses to complete 100% of the work. However, if the firm or general contractor small business utilizes a non-small business subcontractor, FBISD will count the total dollar value of the awarded contract to the firm or general contractor small business, minus the dollar amount subcontracted to non-small businesses. FBISD will count toward applicable small business goals contract awards where good or services are procured from a small business in the form of a prime contractor and without additional small business subcontracting.

        ii. FBISD will count toward applicable small business goals only expenditures to small businesses that perform a commercially acceptable function in the work of a contract. FBISD will count toward the applicable small business goals only expenditures to SBEP Certified firm or general contractors or SBEP Certified first-tier subcontractors. Expenditures to subcontractors below the first-tier subcontract level will not be counted toward an applicable small business goal.

e. FBISD will count toward applicable small business goals contract expenditures for materials and supplies obtained from small business distributors and small business manufacturers, provided that these businesses assume the actual and contractual responsibility for the provision of the materials and supplies, and are a first-tier subcontractor/supplier.

f. FBISD will count toward applicable small business goals the following expenditures to small business firms that are not manufacturers or distributors:

i. The fees or commissions charged for providing a bona fide service, such as professional, technical, consultant, or managerial services, and assistance in the procurement of essential personnel, facilities, equipment, materials, or supplies required for performance of the contract, provided that the fee or commission is determined by FBISD to be reasonable and not excessive as compared with fees customarily allowed for similar services.

ii. The fees charged for delivery of materials and supplies required on a job site (but not the cost of the materials and supplies themselves) when the hauler, trucker, or delivery service is not also the manufacturer of, or a regular dealer in, the materials and supplies, provided that the fee is determined by FBISD to be reasonable and not excessive as compared with fees customarily allowed for similar services.

iii. The fees or commissions charged for providing any bonds or insurance specifically required for the performance of the contract, if the fee or commission is determined by FBISD to be reasonable and not excessive as compared with fees customarily allowed for similar services. SBEP Certified Small Business subcontractors, and shall assure that all such contracts contain the terms set out in all required SBEP provisions.

2. Prior to award, the firm or general contractor shall designate a SBEP contact person who will administer the firm or general contractor's SBEP commitments and who shall be responsible for maintenance of records of Good Faith Efforts to subcontract with SBEP Certified Small Businesses.

3. After award, the firm or general contractor shall (1) submit FBISD Small Business Enterprise Program Utilization Reports to the SBEP office; and (2) make timely payments to all persons and entities supplying labor, materials, or equipment for the performance of the contract.

4. In the event a SBEP Certified Small Business is suspended or removed for any reason, the firm/contractor shall make a Good Faith Effort to replace the small business with another SBEP Certified Small Business.

5. Non-discrimination and Legal Compliance. The SBEP adheres to the FBISD's Non-Discrimination and Harassment Policy. A firm/contractor or SBEP Certified Small Business may be found to have failed to satisfy the Good Faith Efforts of the SBEP if the firm/contractor or SBEP Certified Small Business violates FBISD's Non-Discrimination and Harassment Policy. Furthermore, violations of federal or state law or significant ordinances or regulations of any governmental unit may be deemed a failure to satisfy the Good Faith Efforts of the SBEP.

I. QUALITY CONTROL/QUALITY ASSURANCE

- Architect/Engineer Firm or General Contractor will provide notification to FBISD of SBE subconsultant/subcontractor change.

- Architect/Engineer Firm or GC will provide final SBE Utilization form listing all SBE's used on the project to the FBISD Small Business office.

- Contractor Utilization Report demonstrates the Bidder/Proposer's commitment to prompt payment, non-discrimination practices, the release of retain- age and the inclusion of these clauses in its subcontractor agreements.

  The Pledge must set forth:
  - A pledge that all subcontractors will be paid within FBISD guidelines from the Bidder/Proposer receiving payment from FBISD for amounts previously invoiced.
  - An affirmative statement by the Bidder/Proposer that it has adhered to FBISD Non-discrimination Mandate.
  - For construction contracts only retainage will be released to all sub-contractors within 30 days after satisfactory completion and approval of work performed.
  - Confirmation that the Bidder/Proposer will include the above clauses in its subcontractor agreements.
  - Score Card to constitute SBE Participation goal met.

FORT BEND INDEPENDENT SCHOOL DISTRICT
SUB-CONTRACTOR/SUB-CONSULTANT (INCLUDING SMALL BUSINESS ENTERPRISES) UTILIZATION REPORT

1. Project Name	2. Project Number	3. Application Number	4. Application Date	5. Reporting Period From: To:	6. SBE Goal	7. Scheduled Completion

This report is required by Fort Bend ISD – Failure to comply may result in FBISD commencing proceedings to impose sanctions on the Contractor/Consultant. In addition to pursing other legal remedies, sanctions may include the withholding of payments for work committed to Small Business Enterprises (SBE) participants and a negative recommendation on future bids by the Contractor/Consultant for Fort Bend ISD.

☐ **Note: SBE reporting for this pay period not applicable.**

8. Prime Contractor/Consultant's Name				9.Phone ( )	10.Fax ( )
11.Contractor/Consultant's Street Address / Suite # City State Zip		12. Project Manager (Prime)		13. PM's Phone # ( )	14. PM.'s Fax ( )
15.Current Contract Amount	16.Total Draw This Month	17. % SBE Billed to Date	18. Total Draw on Project to Date		19. % Complete to Date

20. Federal ID Number	21. Sub-contractor / Sub-consultant	22. SBE Status	23. Work Description	24. Amount for Project	25. Amount of Current Draw	26. Total Billed to Date	27. Actual Start Date	28. Scheduled Completion Date

Commencing contract award, partial release of lien is expected from each Sub-contractor / Sub-consultant and shall accompany any application and certification for payment. Prompt payment to CONTRACTOR/CONSULTANT is dependent on appropriate documentation. The signature below of corporate officer attests to the accuracy of the information.

Company Seal

_____ _____
Signature of Company Officer Date

_____ _____
Title Telephone Number

STATE OF TEXAS, _____COUNTY
IN WITNESS WHEREOF, I have hereunto set my hand and official seal this _____ day of _____, 20__.

Notary Public, State of Texas

My Commission Expires_____

PROJECT NAME	CONTRACTOR'S NAME

20. Federal ID Number	21. Sub-contractor / Sub-consultant	22. SBE Status	23. Work Description	24. Amount for Project	25. Amount of Current Draw	26. Total Billed to Date	27. Actual Start Date	28. Scheduled Completion Date
	Total Small Business Sub-contractor(s)/Sub-consultant(s)			$	$	$		
	Total Non-Small Business Sub-contractor(s)/Sub-consultant(s)			$	$	$		
	Total Sub-contractor(s)/Sub-consultant(s)			$	$	$		

FBISD
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INSTRUCTIONS

1. Name of Project
2. Project Number – (If applicable)
3. Application Number – from AIA document G702
4. Application Date is same date as on draw application
5. Reporting Period – from AIA document G702 "From: To:"
6. SBE Goal as set by the prime contractor for this project as applicable
7. Scheduled Completion date for your project per the approved contract or approved change order

8. – 10. Business name of prime contractor – phone & fax

11. Prime contractor mailing address

12.-14. Project Manager's name - phone & fax

15. Amount of contract including original contract amount, change orders and approved alternatives
16. The total of this draw or invoice as authorized on the AIA document G702
17. Percentage of project completed to this date by SBE Sub-contractor/Sub-consultant (Total SBE from Box 26 divided by Box 15)
18. The total amount invoiced on this project to date
19. Total percentage of project completed to date
20. Federal Identification Number
21. Business name of Sub-contractor / Sub-consultant
22. Sub-contractor's / sub-consultant's SBE Certification Designation as applicable (SBE=Small Business Enterprise; N=Non-Small Business Enterprise)
23. Brief description of work each sub will perform. (Roofing, HVAC, trash removal, consulting, etc)
24. List project value total contracted with each sub-contractor / sub-consultant
25. This month's draw amount for each sub-contractor/ sub-consultant
26. To date total billed to each sub-contractor / sub-consultant. The total amount summation must equal the % value listed in box number 17
27. Start date for each sub-contractor / sub-consultant contract
28. Scheduled completion date for each sub-contractor / sub-consultant contract

NOTE:

1. **This form must be submitted with every pay application**
2. **You must submit the partial release of liens with the pay application**
3. **You must have a copy of the SBE certification for <u>every</u> certified SBE sub-contractor/ sub-consultant on the job**
4. **If no SBE for reporting period is required, check the box indicating: "Note: SBE reporting for this pay period not applicable"**
5. **<u>This form must be notarized for each pay application or invoice submitted. The pay application can not be processed without this required certification</u>**

FBISD
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FORT BEND INDEPENDENT SCHOOL DISTRICT

SUB-CONTRACTORS/SUB-CONSULTANTS/SUPPLIERS PAYMENT CERTIFICATION FORM

Instructions:
1. This form shall be completed and signed by an officer of the Sub-contractor's/Sub-consultant's company for each payment received from the Prime Contractor and shall be returned to the Prime Contractor for its submission to FBISD.
2. The Prime Contractor shall attach this completed form to each application for payment submitted to FBISD.

PROJECT NO./TITLE: _____

NAME OF SUB-CONTRACTOR: _____

ADDRESS: _____

I hereby certify that the above firm has received payment on _____ from _____
(Date) **(Prime Contractor)**

in the amount of $_____ as full payment of our Invoice No. _____ dated _____

for work performed during _____ under Contract/Project No. _____
(Enter Time Period)

Signature: _____

Name (Print or Type): _____

Title: _____

Date: _____

Telephone: _____

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Daily construction reports.
   2. Material and equipment delivery status reports.

B. Related Sections:
   1. Division 01 Section “Construction Progress Schedule”.
   2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   3. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format. These documents are to be uploaded into the Owners designated software (Kahua/ Kahua):
   1. PDF electronic file. Submit and upload into owner’s designated software.

B. Daily Construction Reports: GC to submit Daily Construction Reports. These reports are to inform the Owner and Owner’s Program Manager the progress of the work being performed and work being completed. The GC shall report known deviations from the Contract Documents, any defects and deficiencies observed in the work. Reports and any required supporting documents such as photographs, test reports, etc. must be submitted in Owner designated Software.

C. Material and Equipment Delivery Status Reports: Submit at weekly construction progress meetings.

D. Request For Information (RFI): Submit at time of discovery of differing conditions.

E. Special Reports: Submit at time of unusual event

PART 2 PRODUCTS

2.1 REPORTS

A. Daily Construction Reports: Prepare a daily construction report using the Owners designated software (Kahua/ Kahua) recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. Approximate count of personnel at Project site.
   3. Equipment at Project site.
   4. Material deliveries.
   5. High and low temperatures and general weather conditions, including presence of rain, adverse weather conditions, high winds, impending tropical storms, or hurricanes.

6. Accidents.
7. Meetings and significant decisions.
8. Defects and Deficiencies
9. Photographs
10. Test Reports
11. Unusual events (refer to special reports).
12. Stoppages, delays, shortages, and losses.
13. Meter readings and similar recordings.
14. Emergency procedures.
15. Orders and requests of authorities having jurisdiction.
16. Change Orders received and implemented.
17. Construction Change Directives received and implemented.
18. Services connected and disconnected.
19. Equipment or system tests and startups.
20. Partial completions and occupancies.
21. Substantial Completions authorized.

B. Material and Equipment Delivery Status Reports: Weekly prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

PART 3 EXECUTION – Not Used

End of Section 01 32 00

PART 1 GENERAL

1.1 Description

A. Section includes administrative and procedural requirements for developing, submitting and updating a Critical Path Method (CPM) schedule.

1.2 Quality Control and Quality Assurance

A. The Contractor shall develop and maintain a Project Schedule for each project site (School) in accordance with the requirements of this Section. The requirement for a Project Schedule is included to:
   1. Ensure adequate planning before and during the execution and progress of the Work in accordance with the allowable number of working days and milestones.
   2. Assure coordination and execution of the work among various trades of the Contractor, subcontractors, suppliers, third party utility companies or other related entities that may be involved in the Project.
   3. Assist the Contractor, architect and the Owner in evaluating:
      a. Contract performance relative to the required contract schedule milestones.
      b. Monthly progress.
      c. Proposed Contract Modifications.
      d. Documenting anticipated, requested and or approved time extensions.
      e. The documentation of unplanned events, time extensions and other impacts arising from such events.

B. The project schedule shall show the sequence and interdependencies of activities required for complete performance of the work. The Contractor shall be responsible for assuring all work sequences are logical and show a coordinated plan of the work. The project schedule shall employ computerized CPM planning, scheduling and progress reporting of the work as described in this specification. The Contractor shall create and maintain the schedule using project scheduling software that utilizes the fundamentals of CPM for scheduling. New schools or projects with a value of $5M dollars or more will be required to use P6 scheduling. A variance can be given by owner's representative if requested in writing prior to the NTP.

C. New schools or projects of $5M or more: Within seven (7) calendar days after issuance of Notice to Proceed unless otherwise noted the Contractor shall designate in writing a schedule representative who shall be responsible for coordinating with the PM during development and maintenance of the Project Schedule. The Contractor's representative shall have the expertise to operate the CPM software and be capable of rapidly evaluating alternate scenarios to optimize management capabilities. The Contractor has the option to utilize qualified outside scheduling consultation for the assistance of developing and maintaining the Project Schedule, however, the use of an outside consultant does not relieve the Contractor of responsibilities for compliance of this specification. The Contractor's schedule

representative shall have complete authority to act for the Contractor in fulfilling the schedule requirements of the Contract.

D. All activities shall have at least one predecessor and one successor unless approved by the PM. The exceptions are no predecessor is needed for the Notice To Proceed (NTP) milestone and no successor is needed for the Project Completion milestone.
E. With the exception of the specified contract substantial completion milestone, the contractor shall not use any constraints of any type without prior approval of the Owner.
F. The Baseline Schedule project substantial completion milestone for each campus shall be assigned a "Finish on or Before" constraint. The required contract finish date shall be assigned to track project delivery related to contract requirements. The progress schedule submitted shall not have any constraints without approval from the owner.
G. Each activity's "Activity ID" and "Activity Description" or "Task Name" shall remain unchanged throughout the duration of the project, subsequent to the acceptance by the Owner.
H. An activity's "Activity Description" may only be revised to clarify an activity's original scope. If the scope of an activity increases or decreases, a replacement activity shall be created.
I. PM acceptance shall be obtained prior to making any changes or revisions to an activity's "Activity Description".

1.3 Submittals

A. All CPM Schedules (preliminary and baseline) shall be presented submitted per specification 01 33 00 at review meeting.. One electronic copy in pdf and an accessible format not pdf to be uploaded to Kahua per submittal procedures 01 33 00. The substantial completion date in the detailed CPM schedule shall coincide with the substantial completion date on the contract.
B. Schedule Update: The Contractor shall submit with every payment application a copy of the approved baseline CPM Schedule with a narrative of the progress or delay of scheduled activities.
C. Recovery or Revision to the CPM Schedule: The Contractor shall provide a Recovery CPM Schedule within seven (7) calendar days of any CPM schedule update meeting or at the request of the architect or owner's representative. A recovery schedule to the baseline will be requested if any milestone, completion date or end of Period Performance falls seven (7) calendar days or greater behind scheduled completion of the activity on the CPM schedule(negative float).

PART 2 PRELIMINARY CPM SCHEDULE

2.1 Preliminary CPM Schedule

A. The preliminary CPM schedule will be delivered to the owner's representative and architect within three (3) days of NTP. The preliminary CPM Schedule shall be the basis for the sequence of work during the first sixty (60) calendar days of the Contract while the Project Schedule is being developed, submitted, reviewed and accepted. If the acceptance of the Project baseline CPM Schedule

extends beyond sixty (60) days, the Preliminary CPM Schedule shall be updated according to the requirements stated in paragraph 3.3.

2.2 Schedule Review and Acceptance

A. The PM, Architect/Engineer and the Contractor shall meet within seven (7) calendar days of receipt of any CPM Schedule for joint review. The Contractor shall revise any areas, which, in the opinion of the owner's representative and/or Architect/Engineer, conflict with either the intent of this specification or the timely completion and acceptable coordination of the Project. In the event the Contractor fails to define any element of work activity or logic currently designed and the owner's representative review does not detect this omission or error, such omission or error, when discovered by the Contractor, architect or the owner's representative, shall be corrected by the Contractor.

B. Within seven (7) calendar days after the joint review between the architect, contractor and the owner's representative, the Contractor shall revise the CPM Schedule in accordance with agreements reached during the joint review and submit the revised schedule as project CPM schedule per the deliverable requirements.

C. Acceptance of the CPM project schedule by the architect and owner's representative does not relieve the contractor of any of its responsibility for the accuracy or feasibility of the project schedule. However, to the extent that the accepted Project Schedule is reasonable, it becomes a part of this Contract.

D. Submission and final acceptance by architect and owner's representative of the CPM schedule will be a condition precedent to the application or payment of any progress payments under the contract, unless otherwise agreed upon by the Owner. The owner's representative shall notify the contractor of the Owner's acceptance of the CPM Schedule in writing.

PART 3 PROJECT CPM SCHEDULE

3.1 Project Schedule

A. The Project Schedule shall begin at the project NTP and incorporate the accepted Preliminary CPM Schedule including all required revisions and applicable progress updating as warranted. The baseline project schedule shall indicate a logical sequence of work for each project site (school). Utilize the schedule in planning, scheduling, coordinating and performing the work under this Contract (including all activities of subcontractors, equipment vendors and suppliers). The Project Schedule shall indicate the sequence and interdependencies of activities required for complete performance of the Work.

Proposed durations assigned to each activity shall not exceed ten (10) days unless approved by owner's representative in writing. In developing the baseline project schedule, the Contractor shall be responsible for ensuring that subcontractor work scope and sequencing at all tiers, as well as its own work, is included. If a contract for a subcontractor has not yet been awarded for a certain portion of the work, the Contractor is responsible for the development of the schedule for the

work as described under this section. After the subcontractor award of contract, the Contractor shall modify the current accepted schedule to reflect any changes or revisions for the subcontractor sequence of work and submit for approval to architect and owner's representative. Under no circumstance or event, shall a schedule modification or revision under this paragraph extend a milestone. The baseline project schedule shall comply with the various limits imposed by the scope of work and by any contractually specified intermediate milestone dates and completion dates. The degree of detail shall be to the satisfaction of the architect and the owner's representative.

B. Provide sufficient detail and clarity of form and technique so that all work can be properly controlled and progress monitored by the owner's representative and architect. The project schedule shall consist of, but not be limited to, the following criteria:
    1. Full detail of all major procurement activities including the activities and information contained within the baseline CPM Schedule. Break up all procurement activities for major components and long lead items to include submittal dates, fabrication duration, and expected delivery dates.
    2. Full detail of all major construction activities including the activities and information contained within the CPM Schedule. Add column for responsible party (i.e. owner, subcontractor trade, 3rd party, etc.) for all construction activities.
    3. Multiple Calendars shall be used for establishing Holidays and periods of non-work based on the School Operations Parameter Statement in the Project Information Section of Division 0, concrete curing activities, other weather or ambient temperature sensitive construction activities, and or other work requiring overtime or double shift work.
    4. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures, precipitation and/or saturated soil to ensure recognition, planning and anticipation of intermittent inclement weather throughout the project duration on a monthly basis. In addition, activities of similar nature shall be assigned to independent calendars based on this weather data. Contractor to provide a Weather Log each month as part of their Schedule Submittal.
    5. Activity duration in whole working days with a maximum duration of ten (10) working days each, unless otherwise approved by the owner's representative, except for non-construction activities including mobilization, procurement and concrete curing activities.
    6. For projects where hazardous materials are present and require abatement by the Owner, such abatement activities may take place prior to the Contractor's mobilization and start of any work or they may take place concurrently with the Contractor's work. In cases where abatement activities must take place concurrently with Contractor's work, the Contractor shall

allow for these activities to be incorporated into the Project CPM Schedule as separate activity line items. The Contractor shall allow time for these activities to take place at the appropriate time within the project schedule and shall coordinate their work with such abatement activities.

7. At a minimum, the following guidelines, intermediate and final milestones shall be included in the project schedules for each individual project site (school).
   a. Notice to Proceed
   b. Required Periodic Inspections (examples: rebar, utilities, electrical and mechanical rough-in, overhead and architectural
   c. Time allotted for coordination with and execution of abatement activities
   d. Specific Phase start and finish dates – renovations and additions
   e. CPM Schedule submission and acceptance
   f. Building dry-in
   g. Permanent power
   h. Conditioned air available
   i. Completed testing and acceptance of Life Safety Systems and other critical building components
   j. Completion of ADA upgrades in restrooms
   k. Commissioning, when project requires
   l. Building Flush out, when project requires
   m. Ten percent (10%) minimum float for the project
   n. Substantial Completion
   o. Final Completion
   p. Owner Turn-Over / Start-Up / Project Closeout Activity / Warranty Period / Owner Testing/Training
   q. Earliest Date that Owner can occupy the affected portion of the building (by phase, by complete project, etc.). This shall include all necessary approvals, permits (Fire Marshall Acceptance, Certificate of Occupancy, etc.).

C. The Contractor shall prepare a written narrative explaining the Contractor's approach to construction for the entire project. The narrative shall elaborate on the basis for durations, major equipment to be used, calendars utilized, activity coding applied, smart ID descriptions and all major assumptions used to develop and support the schedule. The narrative shall also include the Contractor's description of the critical path work activity as represented in the baselined project schedule.

D. Deliverable: Within fourteen (14) calendar days after the Notice to Proceed, the project CPM schedule deliverable will be submitted by the Contractor and uploaded to Kahua shall include the following:
   1. Two (2) copies (preferably 11 x 17) of the project schedule delivered at the review meeting. The critical path shall be readily discernible in red ink.
   2. Two (2) copies of the written narrative as described in paragraph 3.1.C.

3. One (1) electronic copy in pdf and an accessible format, not pdf, to be uploaded to Kahua per 01 33 00.

3.2 Schedule Review and Acceptance

A. The architect, owner's representative, and the Contractor shall meet within seven (7) calendar days of submitted CPM project schedule on a date selected by the owner's representative and agreed upon by all. The meeting will be to discuss review the submitted project schedule. If a revision or justification is requested, the Contractor shall re-submit the proposed project schedule within seven (7) calendar days and address all issues to the satisfaction of the architect or owner's representative. Any and all disagreements or interpretations of the meaning or intent of this specification shall be solely dictated by the Owner.

B. The architect, owner's representative and the Contractor shall meet within seven (7) calendar days of receipt of the Contractor's response, if needed, to review, corrections or adjustments of the Contractor's proposed project schedule. Any area, in the opinion of the architect and/or owner's representative, conflicts with timely completion of the project, shall be subject to revision by the Contractor.

C. Within seven (7) calendar days after the joint review meeting and no acceptance of the project schedule, the Contractor shall incorporate revisions as directed by the architect and owner's representative and re-submit the proposed project schedule per the deliverable requirement as stated in paragraph 3.1.D. All further review by the architect and owner's representative and shall be within seven (7) calendar days of receipt of revised schedule by the contractor. This will continue until the architect and owner's representative are satisfied.

D. The owner's representative shall notify the Contractor in writing of final acceptance of the Contractor's Project Schedule using submittal approval procedures stated in section 01 33 00 and the project schedule will become baseline for the project. The baseline schedule will not be changed through the life of the project unless requested by owner or owner's representative in writing.

E. In the event the Contractor fails to define any element of work, activity or logic in the project schedule during the review and the owner or owner's representative does not detect this omission or error, when discovered it shall be corrected by the Contractor and amended to the project schedule as soon as possible. The process of approving Contractor's schedules and updates to Contractor's schedule shall not constitute a warranty by the Owner that any non-Contractor milestones or activities will occur as set out on Contractor's schedule.

3.3 Schedule Updates

A. After the Project Schedule is accepted by the architect and owner's representative and the Contractor, it shall be "baselined" and used as a comparison for future progress updates.

B. If the Contractor's schedule reflects or the architect and/or owner's representative determines, that the Contractor is at least ten percent (10%) or at least negative seven (-7) calendar days behind the "baselined" schedule, the Contractor shall provide a revised or recovery schedule. The Contractor's revised or recovery schedule must

incorporate a proposed plan for bringing the work back on schedule and completing the work by the contract completion date at no additional expense to the Owner. A narrative indicating the revised approach to schedule recovery is to accompany the recovery schedule submittal. The revised or recovery schedule shall be in accordance to paragraph 1.3.B.

C. Out-of-Sequence progress logic shall be reviewed by the contractor's scheduler and corrected before submitting the progress update.

D. The percentage of all work shall be calculated by estimating the actual remaining duration time for each progressed activity. The data date of each schedule update shall be determined by the owner's representative. Contractor prepared estimates of the percent completion of each scheduled activity and the necessary supporting data shall be submitted.
    1. One (1) original baseline schedule indicating actual activity start and/or finish dates and revised (current) remaining durations.
    2. A narrative report shall be included that indicates in writing those activities the Contractor knows to be seven (7) days beyond the baseline schedule completion date and current or anticipated conditions that have delayed or may delay the work in order to discuss remedial action. The Contractor shall also explain, for work that reflects less than satisfactory progress, whether any uncompleted and/or upcoming work will (or will not) be affected in a like manner and the Contractors method of correction. Any additional written information necessary to support the updated schedule including explanations of revisions to activities: logic, durations, resources, etc.

E. In case of disagreements at the project progress meeting concerning actual progress to date, the Owner or owner's representative determination shall govern. Upon completion of the schedule update meeting, the Contractor shall revise the schedule update to reflect progress as of the date of the schedule update meeting and any approved revisions to the schedule update and carry out a computer produced calculation to determine the status of the project schedule.

F. Each Schedule Update shall be forwarded to the architect and owner's representative using the owner's project management software per section 1.3.A of this specification within seven (7) calendar days after the schedule update meeting and shall include a narrative report with the following information:
    1. Activities that have been added to the project schedule update.
    2. Activities that have been deleted from project schedule update.
    3. Activities that have "Actual Starts" prior to the month of this project schedule update and remain unfinished.
    4. Activities that have "Actual Starts and Actual Finishes" in the month of this project schedule update.
    5. A description of any approved revisions to the activity descriptions, schedule logic, or initial activity durations.

6. One (1) electronic copy of the updated CPM schedule update indicating the progress made up to the date of the schedule update and indication of any revisions to the CPM schedule update uploaded to Kahua per 1.3.A of this specifications.
7. One (1) electronic pdf format written narrative as described in paragraph 3.3.F and uploaded to Kahua with the updated schedule.
8. One (1) native "xer" electronic file with the native updated schedule for the owner's review. Transmittal by Email to the PM with a transmittal cover sheet uploaded to Kahua with the schedule pay application files.
9. A list of all days occurring for the life of the project that may have impacted the schedule. Determination on the validity of the impact will be established at the recovery schedule meeting. If all parties cannot agree the owner's representative's determination shall govern.

3.4 Revisions to the Project Schedule

A. The Contractor may also request revisions to the project schedule in the event the contractor's planning for the work is revised. If the Contractor desires to make changes in the project schedule to reflect revisions in his method of operating and scheduling of the work, the contractor shall notify the architect and owner's representative in writing, stating the reason for the proposed revision. If revision to the schedule is contemplated, the architect or owner's representative shall so advise the other in writing at least seven (7) calendar days. A schedule update meeting will be requested by the contractor describing the revision and setting forth the reasons thereof.

3.5 Project Float Time

A. Float time is not for the exclusive use or benefit of either the contractor or the Owner. Contractor's work shall proceed according to early start dates, and the Owner shall have the right to reserve and apportion float time according to the needs of the project. The contractor acknowledges and agrees that actual delays, affecting paths of activities containing float time, will not have any affect upon contract completion times, providing that the actual delay does not exceed the float time associated with those activities.

3.6 Impact Analysis for Change Orders, Delays, and Contractor Requests:

A. When changes are initiated or the Contractor desires to revise the project schedule, the contractor shall submit to the architect and owner's representative a narrative explaining the time impact to the project. The narrative will be sent to the architect and owner's representative via transmittal from Kahua and a schedule review meeting will be scheduled within seven (7) days or at the convenience of the architect and owner's representative.
B. Activity delays shall not automatically mean that an extension of time of any milestones is warranted or due to the contractor. A change or delay may not affect existing critical activities or cause non-critical activities to become critical. A change or delay may result in only absorbing a part of

the available total float that may exist within an activity chain of the network, thereby not causing any effect on any milestone.

C. A comprehensive narrative of each time impact shall be submitted within seven (7) calendar days after the commencement of a delay or the notice for a change is given to the contractor.

D. Recommendation to the Owner for the acceptance or rejection of each time impact will be made by the architect and/or the owner's representative. Recommendations shall be made within seven (7) calendar days after a schedule review meeting has taken place, unless subsequent meetings or negotiations are necessary. After a decision has been made by the Owner an acceptance notification will be sent by the owner via change order with approved time if accepted. All approved changes shall be incorporated into the baselined schedule prior to the next pay application by the contractor.

End of Section 01 32 16

SECTION 01 32 23 - SURVEY AND LAYOUT DATA

PART 1 G E N E R A L

1.1 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Owner's Representative if required by the Contract.

1.2 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name, address, and telephone number of Surveyor to Owner's Representative before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.3 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.

C. Submit record documents under provisions of Division 1.

1.4 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify Owner's Representative immediately if any discrepancies are discovered.

1.5 SURVEY REFERENCE POINTS

A. The Owner will establish survey control datum as indicated on Drawings. Inform Owner's Representative in advance of time additional horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to the Owner or Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Owner's Representative a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.

D. Promptly report loss or destruction of reference points to Owner's Representative.

E. Reimburse the Owner for cost of reestablishment of permanent reference points disturbed by construction operations.

1.6 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:
   1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevations.

D. Periodically verify layouts.

1.7 AS-BUILT SURVEY REQUIREMENTS

A. Detention Ponds:
   1. If a detention pond is included in scope of work, Contractor shall provide Owner and Engineer an As-Built survey of said detention pond for volume verification prior to seeding/sodding or covering pond. Contractor shall provide two hard copies and one AutoCAD file with points.
   2. For open ponds, survey shall include enough information for Engineer to perform volume verification calculations. Items shall include but not be limited to: top of bank delineation and elevations, toe of slope delineation and elevations, pilot channels (or center swale) and elevations, and inflow/outflow structures. Survey grid shall be 50’ maximum. Survey shall extend a minimum of 20’ outside top of bank of pond.
   3. For below grade (underground) ponds, survey shall include but not be limited to: layout of below grade structure including pipe sizes, box culvert sizes, etc. and flowlines of structure.
   4. As-Built survey shall be signed and sealed by a registered Land Surveyor.

B. Outfalls to Harris County Flood Control (HCFC) Channels:
   1. HCFC requires an As-Built Certificate for all newly constructed outfalls to their facilities. The Contractor shall provide Owner and Engineer an As-Built Certificate of any newly constructed outfalls to HCFC facilities. The As-Built survey shall include but is not limited to: detailed sketch of outfall, flowline of outfall, size and pipe type of outfall and flowline of existing channel. Survey shall include area of at least 20’ around outfall.
   2. As-Built survey shall be signed and sealed by a registered Land Surveyor.

C. Sites located in the 100-year Floodplain:
   1. Sites located in the 100-year Floodplain will require an As-Built Certificate. Contractor shall provide Owner and Engineer an As-Built Survey (2 hard copies) of completed site for use in filling out said As-Built Certificate. Survey shall include but is not limited to: finished floor elevation(s) of all slabs (including recessed interior slabs, raised interior slabs and bottom of elevator pits), paving elevations, outside mechanical equipment elevations (A/C units, chillers, compressors, etc.) and all fill placed within 100-year floodplain. Survey shall include entire site.
   2. Contractor shall coordinate with Engineer for exact Governmental requirements prior to survey.
   3. As-Built survey shall be signed and sealed by a registered Land Surveyor.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N – Not Used

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.
   4. Periodic construction video recordings.
   5. Owner designated software

B. Related Sections:
   1. Division 01 Section "Unit Prices" for procedures for unit prices for extra photographs.
   2. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
   3. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
   4. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
   5. Division 02 Section “Structure Demolition” for photographic documentation before building demolition operations commences.
   6. Division 02 Section "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.
   7. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files in the quantities and at the intervals described in paragraph 3.1 of this section.
   1. Digital Camera: Minimum sensor resolution of 10 mega pixels.
   2. Format: Unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name of Contractor.
      c. Date photograph was taken.

d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
e. Unique sequential identifier keyed to accompanying key plan.

C. Construction Photographs: The project requires comprehensive documentation of construction progress and post inspection milestones. Submit electronic copies of each photographic view in the quantities and at the intervals described in paragraph 3.1 of this Section.
1. "Progression" photo sets are to be performed at periodic intervals throughout the duration of construction, as applicable to the scope and as follows:
a. Site survey (Pre-construction): A one-time shot that provides coverage of site and immediate surroundings.
b. Interior progression shots: Broadly track the improvements from logical perspectives, to be performed at regular intervals and coordinated with pace of erection.
c. Pre-slab/Pre-Chase/Interior record shots: Underground or concealed utilities will be documented post inspection/pre-insulation and prior to pouring slabs, backfilling or closing chases/walls/ceilings.

D. Video Recordings: Submit video recordings in accordance with paragraph 3.2 of this Section.
1. Submit video recordings in digital electronic format.
2. Identification: With each submittal, provide the following information:
a. Name of Project.
b. Name of Contractor.
c. Date recording was recorded.
d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
e. Weather conditions at time of recording.

1.4 QUALITY ASSURANCE
A. Photographer Qualifications: An individual who has the basic skills necessary to record digital photographs and electronic recordings.

1.5 COORDINATION
A. Auxiliary Services: Provide auxiliary services necessary, including temporary lighting required to produce clear, well-lit photographs.

1.6 USAGE RIGHTS
A. Contractor will transfer copyright usage rights if necessary to Owner for unlimited reproduction of photographic documentation.

PART 2 PRODUCTS

2.1 PHOTOGRAPHIC MEDIA
A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 10 mega pixels.
B. Digital Video Recordings: Provide high-resolution, digital video recordings.

PART 3 EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Taking photographs or video recordings with students and schools staff included on the photograph is strictly prohibited.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date in file name for each image.

C. Preconstruction Photographs: Before starting demolition or construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, or as directed by Architect.

D. Periodic Construction Photographs: Take photographs and submit with daily field report in Kahua. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take a minimum of 20 color photographs after date of Substantial Completion for submission as project record documents.

3.2 CONSTRUCTION VIDEO RECORDINGS

A. Owner's Training: Record video during the manufacturer's training session. Deliver the recordings with the O&M Manual(s).

B. Submit videos in electronic format on flash drives. Label all videos according to the equipment the training is about.

End of Section 01 32 33

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections but not limited to:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment.
2. Division 01 Section "Schedule of Values" for submitting the schedule of values.
3. Division 01 Section "Project Management and Coordination" key personnel.
4. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
5. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Division 01 Section "Demonstration and Training" for submitting video recordings of equipment demonstration and training of Owner's personnel.

C. Refer to other Division 1 Sections and other Contract Documents for Specifications on administrative submittals. Such submittals include, but are not limited to the following:

1. Permits.
2. Payment Applications.
3. Inspection and Test Reports.
4. Schedule of Values
5. Progress Reports.
6. Listing of Subcontractors

D. Shop Drawings are technical drawings and data that have been specially prepared for this Project, including but not limited to the following items:

1. Fabrication and installation drawings.
2. Setting diagrams.
3. Shop-work manufacturing instructions.
4. Templates.
5. Patterns.
6. Coordination drawings (for use on-site).
7. Schedules.
8. Design mix formulas.
9. Contractor's engineering calculations.

Standard information prepared with specific reference to a Project is not considered to be shop drawings.

E. Product Data includes standard printed information on manufactured products that has not been specially prepared for this Project, including but not limited to the following items:
   1. Manufacturer's product specifications and installation instructions.
   2. Standard color charts.
   3. Catalog cuts.
   4. Rough-in diagram and templates.
   5. Standard wiring diagrams.
   6. Printed performance curves.
   7. Operational range diagrams.
   8. Mill reports.
   9. LEED specific information (as applicable)
   10. Standard product operating and maintenance manuals.

   Modify standard product data, drawings and diagrams to delete information not applicable to the project, and / or supplement standard information to provide specific data that is applicable to the work.

F. Samples are physical examples of Work, including but not limited to the following items:
   1. Partial sections of manufactured or fabricated work.
   2. Small cuts or container of materials.
   3. Complete units of repetitively used materials.
   4. Swatches showing color, texture and pattern.
   5. Color range sets.
   6. Units of work to be used for independent inspection and testing.

G. Miscellaneous Submittals are work-related, non-administrative submittals that do not fit in the three previous categories, including but not limited to the following:
   1. Specially prepared and standard printed warranties.
   2. Maintenance agreements.
   3. Workmanship bonds.
   4. Survey data and reports.
   5. Project photographs.
   6. Testing and certification reports.
   7. Record Drawings.
   8. Field measurement data.
   9. Operating and maintenance manuals.
   10. Keys and other security protection devices.
   11. Maintenance tools and spare parts.
   12. Overrun stock.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and/or Contractor's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that may or may not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections. Submittal schedule will be delivered by contractor within 7 days of NTP.

1. Coordinate submittal schedule with list of subcontracts and Contractor's construction schedule.
2. Submit revised submittal schedule monthly to reflect changes in current status and timing for submittals.
3. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: i.e. Action, informational, shop drawing.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's final release or approval.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Contractor must process Submittals using the Owners designated software (Kahua).

B. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings. Architect will use transmittal in owner's

designated software to record distribution of CAD drawings or other electronic files.
    a. Digital Drawing Software Program: The Contract Drawings may be in AUTOCAD format.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
    1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
    3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
    4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
        a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
        b. Coordination/ approval of certain submittals may be required by either owner or owner designated consultants.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
    1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
    2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
    3. Resubmittal Review: Allow 14 calendars days for review of each resubmittal.
    4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

E. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
    1. Indicate name of firm or entity that prepared each submittal on label or title block.
    2. Include the following information for processing and recording action taken:
        a. Project name

b. Date
c. Name of Architect
d. Name of Contractor
e. Name of subcontractor
f. Name of supplier
g. Name of manufacturer
h. Submittal number or other unique identifier, including revision identifier.
    1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
    1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
    2. Name file with submittal number or other unique identifier, including revision identifier.
        a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
    3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
    4. Include the following information on an inserted cover sheet as applicable:
        a. Project name.
        b. Date.
        c. Name and address of Architect.
        d. Name of Contractor.
        e. Name of subcontractor.
        f. Name of supplier.
        g. Name of manufacturer.
        h. Number and title of appropriate Specification Section.
        i. Drawing number and detail references, as appropriate.
        j. Location(s) where product is to be installed, as appropriate.
        k. Related physical samples submitted directly.
        l. Other necessary identification.
    5. Include the following information as keywords in the electronic file metadata:
        a. Project name.

b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

G. Options: Identify options requiring selection by the Architect.
H. Deviations: Identify deviations from the Contract Documents on submittals.
I. Transmittal: Assemble each submittal individually and upload to owner's designated software. Use submittal procedures to direct submittals to the party or parties responsible for review and approval of submittal. Reviewers will return submittals using the owner's designated software submittal reviewer procedure.
J. Resubmittals: Make resubmittals in same form as initial submittal and use owner's designated software submittal procedure.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Post electronic submittals as PDF electronic files directly to the appropriate location within the Owners designated software
a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Submit electronic submittals via the Owners designated software as PDF electronic files.
a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Action Submittals: Submit informational submittal with request for Architect to review action submittal and provide date and time for event.
a. Create individual action submittal using owner's designated software. Provide cover page per section F.4. Provide pictures, copies of emails or other proof Architect and contractor have reviewed action submittal.
4. Informational Submittals: submit as PDF electronic files directly to the appropriate location within the Owners designated software.

5. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
6. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
7. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data in the following format:
      a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data**,** unless submittal based upon Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
   h. PDF electronic file.
   i. Primitive native file if requested by architect or owner.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Architect to approve sample size.
      a. Number of Samples: Submit three sets of Samples. Architect will retain one with option to provide owner a sample; Sample sets; remainder will be returned.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Submit subcontract list in the following format:
      a. PDF electronic file.
      b. Number of Copies: Three paper copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

F. Qualification Data: Prepare written in pdf format information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, and other information specified.

G. Welding Certificates: Prepare written in pdf format certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

H. Installer Certificates: Submit written in pdf format statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

I. Manufacturer Certificates: Submit written in pdf format statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

J. Product Certificates: Submit written in pdf format statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

K. Material Certificates: Submit written in pdf format statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

L. Material Test Reports: Submit reports in pdf format written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

M. Product Test Reports: Submit written reports in pdf format indicating current product produced by manufacturer complies with requirements in

the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research Reports: Submit written in pdf format evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
    1. Name of evaluation organization.
    2. Date of evaluation.
    3. Time period when report is in effect.
    4. Product and manufacturers' names.
    5. Description of product.
    6. Test procedures and results.
    7. Limitations of use.

O. Preconstruction Test Reports: Submit reports written in pdf format by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

P. Compatibility Test Reports: Submit reports written in pdf format by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

Q. Field Test Reports: Submit reports in pdf format indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents. Submit reports in owner’s designated software

R. As pdf file upload in owner’s designated software with daily report for the work by contractor.

S. Design Data: Prepare and submit written in pdf format and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
    1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect using owner’s designated software in RFI module.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit in pdf format a copy of certificate, signed and sealed by the responsible design professional,

for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT/ENGINEER'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

1. Action Stamp: The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory stamp, appropriately marked and executed to indicate the status of the submittal.

C. Informational Submittals: Architect will review each submittal. Architect will upload each submittal to owner's designated software in the RFI module following the reviewer procedure.

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review. Architect will notify contractor through owner's designated software via the RFI module or via email the submittal is incomplete.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Submittals that are required per contract agreements may be reviewed and approved by owner or owner's representative.

End of Section 01 31 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, FBISD Safety Program Guidelines Manual, apply to this Section.

1.2 CONSTRUCTION SAFETY AND LOSS CONTROL PROGRAM

A. Contractor, along with the Subcontractors of all tiers, shall develop a composite Safety Program. The safety plan establishes minimum standards of performance regarding safety during the course of the work on the project. The prevention of job-related injuries and illnesses may require additional safety devices and/or procedures beyond these minimum standards. This Safety Program will include enforcement of safe practices, instructions, and direction in the use of safety equipment and personal protective equipment, and other such activities as may be necessary and appropriate to maintain job safety and accident prevention. A copy of the site-specific plan shall be submitted to the FBISD Project Manager for review prior to starting work onsite following submittal procedures outlined in 01 33 00.

B. Implementation and enforcement of the Safety and Loss Prevention Program for the work force of Contractor and all Subcontractors shall be responsibility of Contractor. Owner or representatives of the owner may conduct periodic jobsite safety inspections to monitor compliance with the Safety and Loss Prevention Program. If Contractor activities are not in compliance with their Safety and Loss Prevention Program, Owner or owner's representative will inform the Contractor in writing of the observed noncompliance, or safety hazards using owner's designated software. These items must be corrected in a timely manner. If the Contractor fails to correct any safety non-compliance or hazard, the Owner shall have the right but not the obligation to perform the correction action and withhold costs associated with the corrective action from the Contractors next or final payment. The owner or owner's representative reserve the right to shut down the job until corrections have been initiated and documented.

C. It is not the intent of this Contract to require the Owner, to provide services, assume responsibility or accept liability for the safety of work sites or any aspect of the work by Contractors or Subcontractors. Each contractor shall bear sole and exclusive responsibility for safety in all phases of their work. Nothing contained herein shall relieve such responsibility.

D. The Owner's role in achieving construction safety and health objectives include overall supervisory management for site safety. This responsibility does not supersede, override or take precedence over that of construction Contractors, who are ultimately responsible for the safety and health of their employees, Subcontractors, visitors, students, staff, the public and protection of property. The primary functions of the Owner as it relates to construction safety and health are to monitor Contractor compliance with the safety and health standards required by law and to

administer and enforce the conditions of the contract pertaining to safety, health, and security.

E. Each Contractor and Subcontractor shall comply with all applicable safety related laws, including the following:
    1. Walsh-Healy Public Contracts Act 9 (Title 41 CFR, Part 50-2-3) and the included rules and regulations contained in the Occupational Safety and Health Standards, and Established Federal Standards (Title 20 CFR, Part 1910 and CFR, Part 1926).
    2. U.S. Department of Transportation Safety Requirements – Federal Highway Projects, 1968, including the requirements referred to in Appendix A therein.
    3. State and local codes and regulations.
F. Safety Documentation Reporting: Contractor shall submit to Owner and owner's representative the following reports upon request:
    1. All accident investigation reports shall be submitted no more than 24 hours after occurrence. The Contractor must maintain accurate records of personal injury and property loss, cooperate and aid in investigation of cases, and implement appropriate actions to prevent recurrence. Owner's representative shall be notified immediately following all accidents.
    2. A binder shall be maintained on site documenting safety orientation of new hire employees and shall be submitted when requested.
    3. Weekly Contractor-held safety meeting reports shall be logged in a binder on site and submitted upon request.
    4. Weekly site safety inspection reports performed by Contractor shall be logged in a binder on site weekly.
    5. Safe Plans of Action (SPA) shall be completed by the contractor prior to each task if required by loss and safety prevention plans and submitted upon request.
    6. Task Safety Awareness (TSA) meeting documents shall be maintained by the contractor if required by loss and safety prevention plans for review by the FBISD Project Manager upon request.
    7. A summary log of all accidents and injuries including first-aid treatments is to be maintained on site and submitted upon request.
    8. Crane re-certifications on an occurrence basis and proof of certification prior to beginning work shall be maintained in a log on site and submitted upon request.
    9. A Job Safety Analysis (JSA) shall be performed, signed off by all crewmembers, job superintendent; and Contractors competent person prior to all lifting activities using any means.
    10. Crane Safety – all crane operations will require a JSA for all hoisting operations; copy of the crane lift chart marked with longest and heaviest lifts; all crew members to sign off on JSA; barricade tape around crane at all times; need crane crew to

indicate on a copy of the crane's lift chart where the highest and heaviest pick is located; tail swing location, etc.

11. A summary of contractor's OSHA Safety Violations and Citations for the site will be submitted to owner or owner's representative 4 working days prior to the opening Inspection Conference.
12. A notice of work termination shall be submitted via transmittal in owner's software to owner or owner's representative by the Contractor within 10 calendar days of a Subcontractor completing work under its Contract and leaving the jobsite.
13. A site-specific safety plan must be submitted via submittal procedure 01 33 00 within thirty (30) days of NTP. The final site-specific safety plan must be accepted by Owner prior to approval of first pay application.
14. Name and qualifications of an on-site safety person will be documented within the site-specific safety plan prior to approval of plan.
15. List of Hazardous Substances brought on site and SDS for each item.
16. Copy of OSHA 300 log for their project.
17. Accident and injury reports within 24 hours of occurrence.

1.3 SITE SAFETY DEVICES

A. Contractor and its Subcontractors performing work at project site maintain responsibility for providing all safety related equipment such as, but not limited to, testing equipment, safety valving, chains, locks, alarms, signal, signage, and personal protective equipment necessary to protect site workers, students, staff, and the general public.
B. Employees on walking and/or working surfaces with unprotected sides or edges six feet (6') or higher above a lower level shall be protected from falling by the use of guardrails, nets or personal fall arrest systems. This shall include, but is not limited to employees on the face of formwork, reinforcing steel or structural steel during and after erection, exterior and interior masonry work, roofing work, window installation, electrical work, mechanical work, and all other trades that require crafts/workers to work in areas where the height exceeds six feet (6') above the ground or work surface.
C. One hundred percent (100%) personal eye wear and head wear protection is required in all construction work areas and shall be worn at all times by employees of both the contractor and subcontractors (regardless of subcontractor tier). Protective eye wear shall conform and meet requirements stated in ANSI 287.1-1968.
D. Clean-Up and Waste Disposal. Contractor shall perform a daily site cleanup and otherwise keep the Project Site free from accumulation of waste materials, rubbish and other debris resulting from the performance of the Work. The Contractor shall also be responsible for providing mowing / grass cutting services for areas inside of the construction areas weekly. Contractor shall, in compliance with Applicable Laws, remove, transport, and dispose of any Hazardous Substance transported onto the Project Site by or on behalf of Contractor or any Subcontractor's activities

at the Project Site. Contractor shall notify the Project Company immediately upon the discovery of the presence of any Hazardous Substance on, or the release of any set forth above, Contractor shall not be responsible for the transportation, handling, storage or removal of any Hazardous Substances which existed at, on or in the Project Site prior to commencement by Contractor of the Work.

1.4 RESPONSIBILITY

A. Each participant involved in the construction of the project is individually responsible for conducting their activities to ensure compliance with all applicable project safety and health requirements. The owner and owner's representative are on site as observers and will help to monitor the approved contractor's loss and safety prevention plan and enforce federal, state, and local regulations or codes. The Contractor and the Contractor's Site Safety Manager is responsible for detailed monitoring of construction activities.

1.5 CONTRACTOR SITE SAFETY MANAGER RESPONSIBILITIES

A. The Contractor's Site Safety Manager is responsible for implementing the safety and health plan at the project level. The following specific safety and health plan guide will be followed:
    1. Pre-plan work activities through the use of Safe Plans of Action (SPA) in order to identify and control and safety and health issues, which may pose a hazard to employees or others.
    2. Contractors are responsible for completing Safe Plans of Action (SPA) and communicating them to employees prior to beginning each work task. This communication of safe work practices will be documented through the Task Safety Awareness meeting and form.
    3. Establish and maintain a safe and healthy work environment by adhering to the guidelines and procedures issued in the latest document of the Federal, State, local code, and site-specific requirements.
    4. Ensure that all Contractor employees and Subcontractors implement and abide by the safety, health, and security rules and regulations set forth by all regulatory agencies as well as those established by this plan.
    5. Hold, at minimum, weekly meetings with Subcontractors to discuss accident prevention measures, review any accident prevention measures, review any accidents which might have occurred since the last meeting, and institute any additional safety measures necessary to prevent future accidents. Meetings will include incidents, which may pose potential third party claim exposures to the District.
    6. Assure that Owner's staff is knowledgeable of all Contractor Subcontractor safety and health programs. The safety manager will give special attention to those operations, which require a coordinated effort by the Contractor and Owner.
    7. Maintain open and continuing communications between the Owner and the Contractors on safety and health issues.

8. Assure that the safety program general requirements apply to visitors entering the project sites. A visitor's log will be established and maintained at each project.
9. Arrange for specific job safety training for Owner's staff members using or operating special equipment or entering confined spaces and/or the use of other personal protective equipment or other analysis instruments.
10. Require the Contractor personnel complete a thorough investigation of all accidents, occurrences. Reports shall be completed and submitted to the FBISD Project Manager within 24 hours after the occurrences.
11. Assure that safety is the FIRST subject of EVERY Contractor/Subcontractor meeting.
12. Review all safety inspection reports with the Subcontractors during the weekly progress meeting.
13. Prior to the construction activity by any Contractor and/or Subcontractor the Safety Manager will assure that all pre-work job safety analysis submittals have been reviewed.
14. Verify the Contractor has no outstanding safety deficiencies that could result in the delay of payment.
15. Assign and manage additional Contractor safety personnel as warranted.
16. Conduct weekly Contractor safety records and performance audits.
17. Attend safety training sessions as required by the Owner.

1.6 OWNER'S RESPONSIBILITIES

A. Review Contractors/Subcontractors safety plan.
B. Make recommendations for administrative action when Contractors fail to correctly identify safety, health, or environmental deficiencies.
C. Attend Contractor/Subcontractor toolbox safety meetings as deemed necessary.

1.7 CONTRACTOR SITE SAFETY SUPERINTENDENT (for projects exceeding $10 million dollars)

A. The Contractor shall appoint a Competent Site Safety Superintendent. The site safety superintendent may have other responsibilities on the project. Contactor shall submit, in writing, the name and qualifications of the proposed individual to serve as Site Safety Superintendent to FBISD for approval, prior to beginning work. The Site Safety Superintendent shall be qualified to serve in this capacity and shall not be changed without written notice to the FBISD Project Manager. All employee substitutions into this position must be approved by the FBISD Project Manager. The Owner shall have right to require removal of the Site Safety Superintendent should he/she be deemed incompetent, obstructive or ineffective in carrying out the work.
B. The Site Safety Superintendent employed by the Contractor shall have full authority to act and make decisions for the Contractor in safety and loss control related matters.
C. The Contractor's Site Safety Superintendent shall monitor all work to assure that it is being performed in accordance with the requirements of

the Safety Program and site specific Contactor Safety Program. This person shall be present at the work site during regular and other work hours acting the capacity of Site Safety Superintendent.

D. Smoking shall be prohibited on all FBISD jobsites

1.8 SAFETY

A. Conduct weekly safety sessions.

B. Attendance: Mandatory for superintendent and foreman for Contractor and each Subcontractor.

End of Section 01 35 23

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control. Testing and Inspection documentation should be generated using the Owner's designated software.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. Owner will employ and pay for the service of an Independent Testing Laboratory to perform specified testing and laboratory services.

1. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
2. Contractor shall cooperate with the Laboratory to facilitate the execution of its required services.
3. Contractor shall pay for additional samples and tests required for Contractor's convenience or when initial tests indicate work does not comply with Contract Documents.
4. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
5. Specified tests, inspections, and related actions do not limit Contractor's other quality- assurance and -control procedures that facilitate compliance with the Contract Document requirements.
6. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

C. Related Sections:

1. Division 01 Section "Allowances" for testing and inspecting allowances.
2. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
3. Division 01 Section "Execution" for cutting and patching.
4. Divisions 02 through 49 Sections for specific test and inspection requirements.
5. Division 01 Section "Testing, Adjusting, and Balancing for HVAC" (TAB provided by owner)

1.3 DEFINITIONS

A. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

B. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
C. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
E. Testing Agency: An entity engaged by the Owner to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
F. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
    1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
G. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
C. Conflicts between the specifications and the construction documents. The most stringent requirement will govern.
D. Conflicts on specification requirements. The most stringent requirement will govern.

1.5 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
B. Schedule of Tests and Inspections: Prepare in tabular form and include the following, as applicable:
    1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following as applicable:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and re-inspection.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory authorized service representative making report.

2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient p roduction capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329, 'Standards of Recommended Practices for Inspection and Testing Agencies for Concrete and Steel as Used in Construction'; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's

products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and re-inspection of construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities:
   1. For tests and inspections performed by the Owner's Testing Laboratories:
      a. Cooperate with Laboratory personnel; provide access to Work and to manufacturer's operations.
      b. Secure and deliver to the Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
      c. Furnish to the Laboratory proposed concrete design mixes, and other material mixes which require evaluation by the Testing Laboratory, a minimum of fourteen (14) days prior to use on the Project.
      d. Furnish incidental labor and facilities
         1) To provide access to Work to be tested.
         2) To obtain and handle samples at the Project site or at the source product to be tested.
         3) To facilitate inspections and tests.
         4) For safe storage and curing of test samples.
         5) Notify Laboratory, PM and Architect sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.
            a) When test or inspections cannot be performed after such notice, reimburse Laboratory for personnel and travel expenses incurred due to Contractor's negligence.
         6) Make arrangements with Laboratory and pay for additional samples, tests, or inspections as required for the Contractor's convenience.

7) Make arrangements with Laboratory and pay for additional samples and tests required when initial test indicate non-compliance with Contract Documents, including load test.

2. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   a. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   b. Retain first subparagraph below if some Specification Sections require an independent testing agency to perform certain tests and inspections.
   c. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   d. Retain first subparagraph below to assure validity of agencies' reports.
   e. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
   f. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
3. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
4. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Re-inspection: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspection, for construction that replaced Work that failed to comply with the Contract Documents.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of

delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses. .

1. Distribution: Distribute schedule to Owner, PM, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 EXECUTION

2.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours. Provide a copy of the log at completion of the project upon request of Architect, owner or owner’s representative.

2.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

End of Section 01 40 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK REQUIREMENTS

A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.

B. “Regulations” is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.

C. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized", "selected", "required", and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. “Testing Agencies”: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and , if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the work to be provided or performed. Unless otherwise indicated, the actual work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction or other entity applicable to the context of the text provision.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the.

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations

1.6 SUBMITTALS

A. Permits, Licenses and Certificates: For the Owner’s records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in

conjunction with compliance with standards and regulations bearing upon performance of the Work. Submit all applicable records via transmittal using owner designated software.

End of Section 01 42 00

TAB SERVICES PROVIDED BY OWNER

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

A. Owner will employ and pay for the service of an Independent Testing Agency for testing and balancing of HVAC systems.

1. The testing, adjusting and balancing (TAB) of air conditioning systems will be performed by an impartial Independent Technical Firm whose operations are limited only to the field of professional TAB. TAB work shall be done under direct supervision of a professional engineer employed by the TAB firm.
2. The Contractor shall cooperate with the Owner provided TAB firm; provide necessary data on design and proper application of system components; furnish labor and materials required to eliminate any deficiencies or mal-performance.

1.2 RELATED WORK

A. Drawings and General Provisions of the Contract, including General, Supplementary and Other Conditions and Division – 1 Specifications Sections, apply to work of this Section.

B. Refer to Division 23 and Division 26 for testing in conjunction with Mechanical and Electrical work.

1.3 LABORATORY DUTIES AND RESPONSIBILITIES

A. HVAC Testing and Balancing:

1. TAB firm shall act as liaison between Owner, Architect, and Contractor and inspect installation of mechanical piping systems, sheet metal work, temperature controls, and other component parts of heating, air conditioning and ventilating systems. Inspection of work shall cover that part relating to proper arrangement and adequate provisions for testing and balancing.
2. Upon completion of installation and start-up on mechanical equipment, check, adjust and balance system components to obtain optimum conditions in each conditioned space in building. TAB agency to submit to Owner, or Owner's delegated representative, complete reports on the balance and operation of systems.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. HVAC Testing, Adjusting and Balancing

1. Have all systems complete in operational readiness prior to notifying TAB firm that Project is ready for their services, and so certify in writing to Owner that such a condition exists.
2. Make any changes in sheaves, belts and dampers or the addition of dampers required for correct balance as required by TAB firm, at no additional cost to the Owner.
3. Provide and coordinate services of qualified, responsible subcontractors, suppliers and personnel as required to correct,

repair or replace any and all deficient items or conditions found during that testing, adjusting and balancing period.

4. In order that systems may be properly tested, balanced and adjusted as required by these specifications, operate said systems for length of time necessary to properly verify their completion and readiness for TAB and pay costs of operations during TAB period.
5. Provide time frame allowance in Contract completions schedule to permit completion of TAB services prior to Owner occupancy.
6. Should TAB be so notified and TAB work commences and the systems are found to not be in readiness or a dispute occurs regarding the readiness of systems, Contractor shall request an inspection be made by a duly appointed representative of Owner, Architect, TAB firm and Contractor. This inspection shall establish to the satisfaction of represented parties whether or not systems meet basic requirements for TAB services. Should inspection reveal TAB services notification to have been premature, Contractor shall pay for costs of the inspection and work previously accomplished by TAB firm. Furthermore, such items as are not ready for TAB services shall be completed placed in operations readiness and TAB services shall again be required.
7. Complete operational readiness, prior to commencement to TAB services shall include the following:
   a. Construction status of building permits closing of doors, windows and ceilings installed to obtain projected operational conditions.
8. Air Distribution Systems:
   a. Verify installation for conformity to design. Supply, return and exhaust ducts terminated and pressure tested for leakage as required by Specifications.
   b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief, shall provide tight closure and smooth operation.
   c. Supply, return, exhaust and transfer grills, registers, diffusers and terminal units installed.
   d. Air handling systems, units and associated apparatus, such as filter sections and access doors, shall be blanked or sealed to eliminate excessive bypass or air leakage.
   e. Fans (supply, return, and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; heater elements shall be proper size and rating; record motor amperage and voltage and verify name plate ratings are not exceeded.

9. Water Circulating Systems:
   a. Check and verify pump alignment and rotation.
   b. Position and valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Strainers shall be removed and cleaned as required during this cycle of operation.
   c. Record each pump motor amperage and voltage. Readings shall not exceed nameplate rating.
   d. Verify electrical heater elements to be of proper size and rating.
   e. Water circulating systems shall be full of water and free of air, expansion tanks set for proper water level and air vents installed at high points of systems and operating freely.
   f. Check and set operating temperature of heat exchangers to design requirements.
   g. Contractor to provide labor and chemical to clean and flush all chill water piping system. Contractor to coordinate with treatment provider to be sure chemicals used are compatible with owner's providers.
10. Automatic Controls:
   a. Verify that control components are installed in accordance with Project requirements and functional, including electrical interlocks, damper sequences, firestats, CO2 sensors, and smoke detectors.
   b. Controlling instruments shall be functional and set for designed operating conditions. Factory pre-calibration of thermostats will not be acceptable.
   c. Temperature regulation will be adjusted for proper relationship between controlling instruments and calibrated by control subcontractor using data submitted by TAB firm. The correctness of final setting shall be proved by taking hourly readings for a period for three (3) successive 8-hour days in a typical room on each separately controlled zone. Total variation shall not exceed two (2) degrees from present median temperature during entire temperature survey period.
11. TAB firm will not instruct or direct Contractor in any of the work, but will make such reports as are necessary direct to Owner. Plans and miscellaneous adjustment devices for purpose of adjustment to obtain optimum operation conditions; install these devices in a manner that will leave them accessible and readily accessible, provide access as required by TAB firm.
12. .
13. Provide approved submittal data on equipment installed and related changes required to accomplish test procedures outlined in this Section of the Specification.
14. Transmit one (1) copy of the following 'Record for Owner' to TAB firm for review and comments:
   a. 'As installed' drawings.

b. Approved Fixture Brochure.
c. Approved Wiring Diagrams.
d. Approved Control Diagrams.
e. Approved Sequence of Operations
f. Shop Drawings.
g. Instructions.
h. Valve Charts.
i. Approved submittals for equipment, devices and accessories

1.5 Typical TAB Agency duties for HVAC TESTING, ADJUSTING AND BALANCING

A. Testing and Balancing Air Systems:

1. Test and adjust air systems to conditions set forth in Plans and Specifications. Air systems include:
   a. Supply Air Systems.
   b. Return Air Systems.
   c. Exhaust Air Systems.
2. In fan systems, air quantities indicated on Plans may be varied as required to secure a maximum temperature variation of two (2) degrees within each controlled space, but total air quantity indicated for each zone must be obtained.
3. Test and adjust blowers and fan to deliver CFM required by systems with concurrent recording of RPM, supply voltage and full load amperes. Report any changes of belts and sheaves required.
4. Mark pitot tube traverses of main supply, return and exhaust ducts and adjust fans and dampers to achieve specified air volumes. Patch and cover the pilot tube holes after air balancing is complete.
5. Test and adjust fresh air intake and return air dampers and louvers to conditions scheduled or required.
6. Test and record static pressure on entering and leaving side of each supply fan, exhaust fan filter, coil and balancing dampers and other components of the system.
7. Test and adjust supply air diffusers, grills, and return air registers to Specification requirements and as shown on Drawings. Adjust supply diffuser patter blades for proper air distribution in each room or space.
8. Measure temperature in each space and concurrent outside temperature.

B. Testing and Adjusting of Water System:

1. Flow of water through water coils shall be adjusted by adjusting valves until rated pressure drop across each coil is obtained and water flow verified by veturi readings. On those with three-way valves, rated pressure drop shall first be adjusted though coils in each of several systems and the temperature differential between inlet and outlet shall be determined to be in accordance with its rating. Bypass valves shall then be adjusted on each coil until an equal pressure drop between supply and return

connections is obtained with three-way valves set to bypass all coils in each of the several systems.

2. Geothermal Heat Pumps TAB shall be performed with a single unit per well field operating. This single unit balancing shall include both the air side, particularly the outside air, and the water side.

C. Testing and Adjusting of Automatic Controls:
   1. Test automatic controls, controlled devices, interlocks, safety devices associated with HVAC system for proper operation and sequence during heating, cooling, intermediate and smoke removal modes of operation. Adjust automatic controls to deliver required quantities of air at temperatures specified or scheduled on Plans and to maintain proper conditions in each room of the building.
   2. Report deficiencies or malfunctions to Owner or owner's representative.

D. Marking of Settings:
   1. Before final acceptance of reports is made, TAB firm shall furnish Owner the following data:
      a. Summary of main supply, return and exhaust dust pilot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
      b. A tabulated record of temperature in all spaces on each separately controlled zone, together with outside temperature at time of measurement.
      c. A list of measured air quantities at each outlet corresponding to temperature tabulation specified above.
      d. Air quantities at each return and exhaust air-handling devices.
      e. Supply pressure readings entering and leaving each supply fan, exhaust fan, filter, balancing dampers and other components of system. These readings shall be related to fan curves in terms of CFM handled.
      f. Motor current readings per phase at each equipment motor. Voltage at time of reading shall be listed.
      g. Water pressure reading at gauge connections. Pressure readings at coils and pumps shall be related to coil and pump curves in terms of GPM flow through metering stations at each coil if applicable.
      h. Water temperature readings entering and leaving each coil and heat exchanger under maximum load conditions in each case.
   2. The final report shall certify test methods and instrumentation used, final velocity ready obtained, air quantities at each outlet supply, return, exhaust, temperature, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items.
   3. A summary of actual operating conditions shall be included on each system outlining normal and/or ventilation cycles of

operation. The intent of final report will provide a reference of actual operating conditions for Owner's operating personnel.

4. '
5. Insure that all systems area balanced at the proper time in the opposite season.

PART 2 PRODUCTS (Not Applicable)

End of Section 01 45 23 01

PART 1 SERVICES - GENERAL

1.1 WORK INCLUDES

A. This Section specifies administrative and procedural requirements for testing and inspection services.

B. Services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.

1. The Contractor shall employ and pay an independent agency, to perform specified quality control services specified in PART 1 - GENERAL, QUALITY ASSURANCE. The cost for these services is not borne by the testing allowance.
2. The Owner will engage the services of an independent agency to perform inspections and tests specified in PART 3 - EXECUTION, QUALITY CONTROL, QUALITY CONTROL TESTING DURING CONSTRUCTION or FIELD QUALITY CONTROL.
3. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity

engaged by the Owner, unless otherwise agreed in writing with the Owner.

4. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
5. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
6. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
    b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
    c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
    e. Security and protection of samples and test equipment at the Project site.

B. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
    1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.
    2. The Owner will employ and pay for the services of an independent Commissioning Agent,TAB services, and Material Testing services.
C. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
    1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor unless informed in writing by the owner or owner's representative.

D. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. Additionally, Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
   1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate or pdf format, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate and pdf format.

B. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

C. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
   1. Date of issue.
   2. Project title and number.
   3. Name, address and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making the inspection or test.
   6. Designation of the Work and test method.
   7. Identification of product and Specification Section.
   8. Complete inspection or test data.
   9. Test results and an interpretation of test results.
   10. Ambient conditions at the time of sample-taking and testing.
   11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting.

1.4 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
   1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

1.5 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements at no additional cost to the Owner.
B. If, in the opinion of the Architect/Engineer or Owner, it is not practical to remove and replace the Work, the Architect or owner's representative will direct appropriate remedy or adjust payment.
C. The defective Work may remain, but sum/price will be adjusted to new sum/price at the discretion of Architect or Owner.
D. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.
E. Authority of Architect/Engineer, or other appropriate agent identified to perform assessment by the Architect/Engineer or Owner, to assess defects and identify payment adjustments, is final.
F. Non-Payment For Rejected Products: In addition to replacement of rejected Work, payment will not be made for rejected products for any of the following:
    1. Products wasted or disposed of in a manner that is not acceptable.
    2. Products determined as unacceptable before or after placement.
    3. Products not completely unloaded from transporting vehicle.
    4. Products placed beyond lines and levels of required Work.
    5. Products remaining on hand after completion of the Work.
    6. Loading, hauling, and disposing of rejected products.

PART 3 - EXECUTION

3.1 SCHEDULE OF INSPECTIONS AND TESTS

Any conflicts with the information below with current best practices, building code requirements, jurisdictional requirements or other agreements the more stringent applies.

A. Soils Tests:
    1. Soil Analysis Method: Make one test for each type of soil used under structures and paving.
        a. Liquid Limit ASTM 04318.
        b. Plastic Limit: ASTM 04318.
        c. Plasticity Index: ASTM 04318.
        d. Moisture-Density Relationship: ASTM 0698 or ASTM D4253, 04254 as applicable.
        e. In-Place Density: ASTM 02922.
        f. One laboratory maximum density test.
    2. Quantity of Analysis: One set for each 5000 sf for each lift
        a. Perform in-place density tests on fill material at building, paving, and utility trenches.
B. Soil Stabilization:
    1. Required Analyses for Fill
        a. Liquid Limit ASTM 04318.
        b. Plastic Limit, Plasticity Index ASTM 04318.
        c. Moisture-Density Relationship: ASTM 0698 or ASTM 04253, 04254 as applicable.
        d. In-Place Density: ASTM 02922.

2. Quantity of Analyses: One set for each 5000 square feet.

C. Portland Cement Concrete Paving:
   1. Three (3) concrete test cylinders will be taken for every 100 or less cubic yards of concrete placed.
   2. One (1) additional test cylinder will be taken during cold weather concreting, and be cured on jobsite under same conditions as concrete it represents.
   3. One (1) slump test will be taken for each set of test cylinders taken.
   4. One (1) set of manufacturer's test data will be required of Contractor for each type reinforcing steel purchased directly from a United States mill.
   5. One (1) set of tension and bending tests on three separate samples for each bar size of each 5 tons of each type reinforcing steel specified.
   6. Cylinder Curing: ASTM C31.
   7. Testing Cylinders: ASTM C39. Test one cylinder for compression at 7 days, one at 28 days, hold one cylinder for testing at 56 days if 25 day test does not meet specified compression strength.
   8. Report test results promptly. ASTM C94 governs acceptance of tested concrete.
   9. Drill and test cores as required when 28-day test results fall below specified strengths. Contractor shall pay for drilling and testing cores.

D. Asphalt Pavement:
   1. Verify Contractor's mix design for compliance.
   2. Required Plant Sampling and Testing
      a. Sieve Analysis of Aggregates ASTM C136.
      b. Sampling Mineral Aggregates: ASTM D75.
      c. Sieve Analysis of Mineral Filler: ASTM D546.
      d. Specific Gravity of Coarse Aggregate: ASTM C127.
      e. Specific Gravity of Fine Aggregate: ASTM C128.
      f. Sampling Bituminous Materials: ASTM D140.
      g. Sampling Bituminous Mixtures: ASTM D979.
      h. Determination of Bitumen Content: ASTM D2172.
      i. Liquid Limit, Plastic Limit, Plasticity Index: ASTM D4318.
      j. Percentage of Coated Particles: ASTM D2489.
      k. Recovery of Extracted Asphalt: ASTM D1856
      l. Penetration of Recovery Asphalt: ASTM D5
      m. Percent of Air Voids in a Compacted Bituminous Paving Mixture: ASTM D3203.
      n. Absolute Viscosity of Asphalts: ASTM D2171.
      o. Cohesion, Resistance to Deformation: ASTM D1560.

E. Field Density Tests: ASTM D2950.
      a. Locations: Subgrade, base courses, surface course.
      b. Number: One for each 1,000 square yards or fraction thereof.
      c. Field Thickness: ASTM D3549.

F. Drilled Footing Inspection:
    1. Soil Shear Strength Test: Test sample of cuffing from each drilled footing with a pocket penetrometer to determine shear strength and compare with anticipated strength presented in the soil report.
    2. Visual Inspection: Determine that cutting tool is set for the correct size. Inspect each drilled footing to determine if the bottom of the excavation is in intended strata of soil type and is free of loose dirt and sand. Notify Architect and Geotechnical Engineer if water is encountered.
    3. Reinforcing Steel: Inspect the reinforcing steel to determine if the size and number of reinforcing bars complies with the specifications and drawings.
    4. Maintain record of footing depth and variations of installation if footing placement requires deviation from Contract Documents.

G. Structural Concrete:
    1. Aggregate Tests:
        a. Typical: Check the proposed aggregate in accordance with ASTM C33.
        b. For concrete 6000 psi and higher, perform ASTM 0799 also.
    2. Mix Design: Check the proposed mixes for proportions, water cement ratio and slump in accordance with ACI 301 and 318.
    3. Slump Tests: Take slump tests per ASTM C143 at the beginning of each day's placing operations and whenever water adjustments or noticeable change of slump occurs, with a minimum of one for each set of test cylinders.
    4. Sampling:
        a. Make five standard cylinders at the beginning of each placement, and five more standard cylinders for every 50 cubic yards placed. Take extra samples at noticeable change in the concrete makeup. Cure per ASTM C192.
        b. Determine and report air content per ASTM C231, 0173, or 0138 for each set of test cylinders.
        c. Perform sampling in compliance with ASTM 0172.
        d. Samples for pumped concrete to be taken at end of line, at location of placement.
    5. Testing:
        a. Test cylinders for compression in accordance with ASTM 039.
        b. Test two lab cured cylinders at 7 days and two field cured cylinders at 28 days averaging test results. Store one (1) cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements.

H. Reinforcing Steel:
    1. Visual Inspection: Inspect reinforcing steel in structural concrete to determine if the size, type, splices, laps, clearances, and number of reinforcing bars complies with the specifications and drawings.

I. Bolted Connections:
   1. Types:
      a. Calibrated torque wrench if washers are used.
      b. If turn of nut method is used without washers, observe the set of every bolt.
   2. Number for Torque Wrench Test: Test minimum two bolts of every third connection between floor beams, girders and columns.
   3. Analysis: If insufficient torque occurs on any tested bolt, test all bolts at that connection at the Contractor's expense.

J. Steel Weld Tests:
   1. Types: One of the following testing procedures may be used on any field or shop weld.
      a. Liquid penetrant.
      b. Magnetic particle.
      c. Radiographic.
      d. Ultrasonic.
      e. Visual inspection at small welds.
   2. Number of Tests: 100% of full penetration and field welds, 10% of other shop welds. Test of shop welds shall be done at fabricator's shop prior to painting and shipping.
   3. Number of Retests: Number of welds to be retested will be determined by the number of welds that fail the initial testing.
   4. All welds that fail shall be re-welded and retested until they pass the test. 5. Test two additional welds for every weld failure at the Contractor's expense.
   5. Weld Quality: Comply with the quality requirements of the American Institute of Steel Construction Manual of Steel Construction.
   6. Testing Laboratory shall obtain and review copy of certification of all welders.

K. Insulating Concrete:
   1. Type of Tests:
      a. Field Wet Density: ASTM C138.
      b. Laboratory Tests: Dry density and compressive strength ASTM C495.
   2. Number of Test Sets:
      a. One per 5,000 square feet.
      b. Not less than one for each day's work.

End of Section 01 45 23 02

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
2. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 DESCRIPTION OF REQUIREMENTS.

A. Connections for temporary and permanent utilities and payment for temporary utilities services required for the Work are the responsibility of the Contractor. Contractors performing renovation work or additions to existing campuses may request a variance on usage to be delivered in writing from the owner or owner's representative via email. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a Change Order. Temporary utilities services required for use at the project site include but are not limited to the following:
   1. Water service.
   2. Temporary electric power and light.
   3. Telephone service.
   4. Provide adequate utility capacity at each stage of construction.
   5. Prior to availability of temporary utilities at the site, provide trucked-in-services for start-up of construction operations.

B. Temporary construction and support facilities required for new construction and additions to existing campuses include but are not limited to the following:
   1. Temporary heat.
   2. Field offices and storage sheds.
   3. Sanitary facilities, including drinking water, handwashing.
   4. Dewatering facilities and drains.
   5. Temporary enclosures.
   6. First aid station, including eye wash station.
   7. Project identification, bulletin boards and signs.
   8. Waste disposal services.
   9. Rodent and pest control.
   10. Construction aids and miscellaneous general services and facilities.
   11. Alternate temporary services and facilities, equivalent to those specified, may be used, subject to acceptance by the Architect/Engineer and owner's representative.

C. Security and protection facilities and services required for Project include but are not limited to the following:

1. Temporary protected interior walkway between occupied building areas.
2. Dust barricade between occupied building areas and work areas.
3. Temporary fire protection.
4. Barricades, warning signs, lights.
5. Sidewalk bridge or enclosure fence for the site.
6. Environmental protection.
7. Alternate security and protection methods or facilities, equivalent to those specified, may be used, subject to acceptance by the Architect/Engineer and owner's representative.
8. The Contractor shall provide a temporary barrier whenever a certain area of the school is sealed off for remodeling work for phasing purposes. The barrier shall be made of 3/4" plywood or drywall, and it shall extend from floor to ceiling, wall to wall. The temporary barrier shall have a door which can be locked. This barrier will remain until work in the specified area is completely finished. The barrier may subsequently be moved to a different location, provided that it still meets the requirements. Proper signage should be displayed near the temporary barrier, according to safety regulations. Any temporary barriers will need to be coordinated with the emergency egress plan of the building.
9. Barrier requirements for minor renovation work will be discussed and agreed upon at weekly progress meetings.

1.4 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Owner, Program Manager, Architect, testing agencies, and authorities having jurisdiction.
B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.
C. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, temporary barricades, site entrance, utility hookups, staging areas, and parking areas for construction personnel. Submit for approval within 7 days of NTP by Architect/Engineer and/or owner's representative using specification 01 33 00 submittal procedures.
B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent. Submit for information to Architect/Engineer and/or owner's representative using specification 01 33 00 submittal procedures.
C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials. Submit for

information to Architect/Engineer and/or owner's representative using specification 01 33 00 submittal procedures.

1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Submit for approval by Architect/Engineer and/or owner's representative using specification 01 33 00 submittal procedures. Include the following:

1. Locations of dust-control partitions at each phase of the work.
2. HVAC system isolation schematic drawing.
3. Other dust-control measures.
4. Waste management plan.

1.6 QUALITY ASSURANCE

A. Regulations: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:

1. Building Codes, including local requirements for permits, testing and inspections.
2. Health and safety regulations.
3. Utility company regulations and recommendations governing temporary utility services.
4. Police and Fire Department rules and recommendations.
5. Environmental protection regulations governing use of water and energy, and the control of dust, noise and other nuisances.
6. In addition, comply with "Environmental Impact" commitments the Owner or previous Owners of the site may have made to secure approval to proceed with construction of the Project.

B. Standards: Comply with the requirements of NFPA Code 241, "Safeguarding Construction, Alterations, and Demolition Operations", the ANSI A10.6 "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".

C. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", as prepared jointly by QUOIN and ASC for industry recommendations.

D. Inspections: Inspect and test each service before placing temporary utilities in use. Arrange for require inspections and tests by governing authorities, and obtain required certifications, and permits for use.

E. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. General: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required and modify temporary services or facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
B. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services of facilities, and do not permit them to interfere with the progress of the Work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
C. Temporary Utilities: Do not permit the freezing of pipes, flooding or the contamination of water sources.
D. Security and Protection: Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.
E. The roof removal and new roof installation shall proceed on a phased basis to minimize risk to the School's ongoing operations and its property. The GC shall be responsible for protection of interior spaces from damage during roofing work.
F. Distribute material, debris, and equipment over the roof deck to avoid damage to the structural deck. Not more than two weeks supply of material shall be stored on a roof at any given time. Place materials and equipment to be stored on the roof as nearly direct over structural members as can be determined. Secure equipment, material, and debris on the roof to prevent movement by wind or other elements. Contractor assumes full responsibility for loading on the structural deck or roofing materials during roof replacement operations.
G. Consult with the A/E and the owner’s representative regarding permission for the use of selected areas of the building. Coordination will also be held with the Principal and / or site staff.
H. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
I. The projects requiring new paved entries, parking lots, or other paving work in excess of 10,000 square feet will consider the work to be critical path. A phasing schedule for installation will be submitted by contractor within seven (7) days of NTP for review by Architect/Engineer and/or owner’s representative using the owner’s designated software via a transmittal.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect/Engineer and/or owner’s representative. Provide only materials

and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

B. Portable Chain-Link Fencing: Minimum 2-inch 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized steel bases for supporting posts.
C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
D. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60.

2.2 TEMPORARY FACILITIES

Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, PM, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
    1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
    2. Conference room of sufficient size to accommodate meetings of 8 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table that will seat 10 attendees, chairs, and 4-foot-square tack and marker boards.
    3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
    4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
    1. These shall be weather tight, structurally sound, compliant with applicable codes and shall be secure
    2. Store combustible materials apart from building.
C. Temporary Construction and Support Facilities: Provide facilities that can be maintained properly throughout their use at the Project site.
D. Self-Contained Toilet Units:
    1. Sanitary facilities include temporary toilets, with facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for type, number, location, operation, and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations that will best serve the Project's needs.
    2. Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or

similar non-absorbent material. Provide at least one for every thirty (20) employees.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures. Provide quantity and type to comply with all local, state, and federal safety codes.
B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
    1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
    2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
    3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction. All return grilles will be replaced upon completion of project if used during construction.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
    1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
    1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
    1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition better than or equal to existing before initial use. If services do not exist Contractor shall provide.
D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Cover all supply and return grills left in place with plastic to prevent dust intrusion.
      c. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
   4. Fire alarm system may be required to be put in test mode temporarily, if site conditions warrants it.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Connect to Owner's existing electric power service if available with written permission from owner or owner’s representative. Maintain equipment in a condition acceptable to Owner. Electrical power service to the project office trailer and other elements and areas of the Contractor’s office and staging area is to be provided by the Contractor by means of a temporary power service with a temporary account separate from the facility electrical power service for new construction projects.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

J. Telephone Service: Provide Wi-Fi service in common-use facilities for use by contractor, architect, owner and owner's representative. Passwords will be provided at first OAC meeting following installation and setup of Wi-Fi system.
   1. Provide superintendent and other contractor management staff with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Parking: Provide five (5) designated, accessible, and secure parking spaces nearest to the project or job trailer for the A/E, owner, and/or owner's representative. Provide temporary parking areas for construction personnel.

C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated in this section.
   2. Temporary Signs: Provide other signs as indicated and as required to inform the public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
      b. Provide warning signs to students, staff, pedestrians, visitors and others for any closed or impeded paths to access and egress in or around the immediate site.
   3. Maintain and touchup signs so they are legible at all times.
   4. No other signs shall be allowed on site with the exception of those that are safety oriented. No signs serving as advertisement shall be allowed.

D. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished

in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

E. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to better than or equal to condition existing before initial use.
    1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

F. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

H. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings. Provide coordination drawings when applicable with locations of proposed areas to A/E and/or owner’s representative via transmittal in owners designated software.
    1. Construct covered walkways using scaffold or shoring framing.
    2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
    3. Paint and maintain appearance of walkway for duration of the Work.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.
    1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas fumes and noise. Provide coordination drawings when applicable with locations of proposed areas to Architect and/or owner’s representative via transmittal in owners designated software.
    1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
    2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
    3. Insulate partitions to control noise transmission to occupied areas.

4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241. Provide coordination drawings when applicable with locations of proposed areas to Architect and/or owner's representative via transmittal in Kahua .
   1. Prohibit smoking on school property per State Law.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.
C. Any new construction materials with visible moisture damage or mold contamination will be removed from the project and replaced at contractors cost.
D. Any existing surfaces suffering moisture damage or mold contamination during construction will be the responsibility of the contractor. Surfaces will be cleaned, replaced, or remediated to owner's satisfaction.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
B. Maintenance: Maintain facilities in good operating condition until removal.

C. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
    1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

End of Section 01 50 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. Section includes requirements for temporary facilities (Swing Space) for the purpose of relocating students to provide temporary classroom facilities during construction activities.

B. Related Sections:

1. Division 00 Section titled “Technical Proposal”
2. Division 01 Section title “Temporary Facilities and Controls”

1.3 DESCRIPTION OF REQUIREMENTS

A. The project management team are to determine whether Swing Space is necessary in order to accommodate the phasing and construction of the project. If students must be displaced from classroom areas due to the phasing and execution of the work according to the Contractor’s work plan, the Contractor shall be responsible for providing, on a turn-key basis, temporary facilities for those displaced students. It will be the responsibility of the Contractor to determine the size and layout of the space based on the particular need and in a manner that will create an adequate classroom facility for the students displaced. Every effort shall be made to avoid temporary portables as swing space, unless there are already in existence at the school, unused. Contractor, PM, and Architect must work with School Principal to find swing space within the school by accommodating school master schedule and space allocation.

B. If the Contractor elects to utilize Swing Space, they must include all costs associated with the procurement including, but not limited to:

1. Equipment purchase or leasing
2. Transport and setup
3. Maintenance of the temporary facilities for the duration of their use (i.e. HVAC, electrical, and other building repair and maintenance needed, not custodial maintenance)
4. Site work and utilities
5. ADA/TAS Accessible ramps and sidewalks
6. Stairs
7. Skirting
8. Interior finish-out
9. Miscellaneous specialties (i.e. marker boards, tack boards, flag holders, map clips, fire extinguishers)
10. Signage
11. Wall Clock and bell to interface with the existing system at the school
12. Furnishings, Fixtures, and Equipment (FF&E)
13. Breakdown, removal, and transport of the Swing Space at the completion of its use
14. Restoration of the site following removal of facilities
15. P.A. to interface with the existing system at the school

16. Data cabling from existing school network electronics sufficient to provide two data drops at each Teacher's desk location.

1.4 SCOPE OF WORK

Provide turnkey services for delivery, set-up, maintenance, removal, and restoration of the site for temporary classroom buildings to accommodate phased construction.

A. Engineering: The Contractor will provide site engineered civil, utility, blocking plan/foundation plan, sidewalk design and deck/ramp design sufficient to receive a Building Permit from the municipality having jurisdiction, for each site for the installation of all temporary classroom buildings.
B. Architectural: The Contractor will provide the building manufacturer's shop drawings approved by the Texas Department of Licensing and Regulation (TDL&R). The Contractor will coordinate T.A.S. submittals to the State and the City as they relate to this scope of work.
C. Permits: The Contractor will coordinate and obtain the permits as required by the City for placement of the classroom buildings at each site. This includes the permits required for the transportation of the classroom buildings.
D. Temp. Facilities: Roll off dumpsters will be provided by the Contractor as required for clean-up during installation and removal of swing space.
E. Clean up: Final broom sweep of the building(s) and removal of trash and debris from each site will be provided by the Contractor prior to occupancy of the swing space by the students and staff. Floor waxing or shampooing will be provided be the Contractor prior to occupancy by the students and staff if needed. Provisions for site restoration upon completion of the delivery of the modules and/or completion of the scope of work will be provided by the Contractor. Upon the removal of the buildings all underground utilities and/or structures associated with the temporary classroom buildings will be removed and discarded. The concrete sidewalks will be removed and discarded. Rough grading will be performed and new sod will be placed to restore the area to its original condition.
F. Site Prep: FBISD has made no provisions for any site preparation and/or demolition as may be required for the delivery and/or installation of the portable buildings. Any site preparation and/or demolition that might be required of for installation of the temporary classrooms will be included in the Contractor's scope.
G. Construction Fencing: The contractor will maintain a clean and safe site environment within the limits of the temporary classroom construction area. Temporary chain link construction fencing 6' high will be installed around the perimeter of the limits of construction.
H. Sodding: Upon the removal of the buildings, the Contractor will provide sod within the limits of construction associated with the temporary classroom scope of work. Any irrigation of the new sod will be provided by FBISD.
I. Site Utilities (if applicable): The Contractor will provide the site utility connections as required for the temporary classroom buildings. If needed,

PM shall negotiate with municipalities having jurisdiction obtaining a variance to the FBISD in which the swing space facilities are not required to have restroom facilities. If required by those municipalities, the Contractor must provide restroom services and utilities as required by local code.

J. Storm: All storm water management and any sedimentation control will be the responsibility of the Contractor. Gutters and downspouts will be installed as needed by the Contractor.
K. Sanitary (if applicable): The Contractor will install all fixtures, stub all sanitary lines below the floor and manifold to one location at the edge of the building(s). All final connections, utility company charges and impact fees that might be required will be included in the Contractor's scope of work. If needed, PM shall negotiate with municipalities having jurisdiction obtaining a variance to the FBISD in which the swing space facilities are not required to have restroom facilities. If required by those municipalities, the Contractor must provide restroom services and utilities as required by local code.
L. Water (if applicable): The Contractor will install all fixtures and stub all water lines to one location at the edge of the building(s). All final connections, utility company charges and impact that might be required will be included in the Contractor's scope of work. If needed, PM shall negotiate with municipalities having jurisdiction obtaining a variance to the FBISD in which the swing space facilities are not required to have restroom facilities. If required by those municipalities, the Contractor must provide restroom services and utilities as required by local code.
M. Natural Gas: No provisions for any gas service are anticipated for FBISD Projects.
N. Life Safety: Building(s) will be approved and inspected by the Texas Department of Licensing and Regulation. Any provisions for fire suppression, fire sprinkler system or fire rated assemblies that might be required will be included in the Contractor's scope of work.
O. Fire Alarm: The contractor will provide and install fire detection systems as required by the building code and the City.
P. Electrical: The contractor will provide and install electrical systems as required by the building code and the City. Temporary electricity costs associated with the swing space will be the financial responsibility of the Contractor unless otherwise directed by the owner in writing.
Q. Mechanical: The Contractor will supply and install the standard end mount HVAC units as provided by the portable building manufacturer. The condensate from both HVAC units of a classroom building will harnessed together and discharged into a 24" diameter by 36" deep french drain filled with gravel. All condensate piping will be PVC but will be protected where directly exposed to UV radiation.
R. Skirting: After the modules are installed, the Contractor will install full perimeter skirting around the building(s) using the same material and finish as that of the building siding to provide a consistent finish down to grade. Sections of skirting will be perforated as required for proper crawl

space ventilation. Access to the crawl space will be accomplished by removing sections of the skirting.

S. Decks/Stairs: The Contractor will install landings at the exit doors of the building(s) within the limits of construction as required by code and the City. Landings will utilize pressure treated wood construction with slip resistant surface treatment and handrails.

T. Ramps: The Contractor will install handicapped accessible ramps at the exit doors of the building(s) within the limits of construction as required by code and the Local City. Ramps will utilize pressure treated wood construction with slip resistant surface treatment and handrails.

U. Sidewalks: The Contractor will install 4' wide, 4" thick, 3,000 psi concrete sidewalks using 6x6 welded wire reinforcing to service the building(s) within the limits of construction. Sidewalks will receive a light broom finish and be poured on select fill and/or sand bed.

V. Foundation and Anchorage: The swing space facilities should be securely anchored to a foundation system which utilizes some means of structural support, as determined by a certified structural engineer. Provide construction documents that depict the foundation system as designed and certified by a structural engineer. The portable buildings shall be anchored to the foundation components in a manner that is structurally sound and that is acceptable to the building manufacturer and the structural engineer.

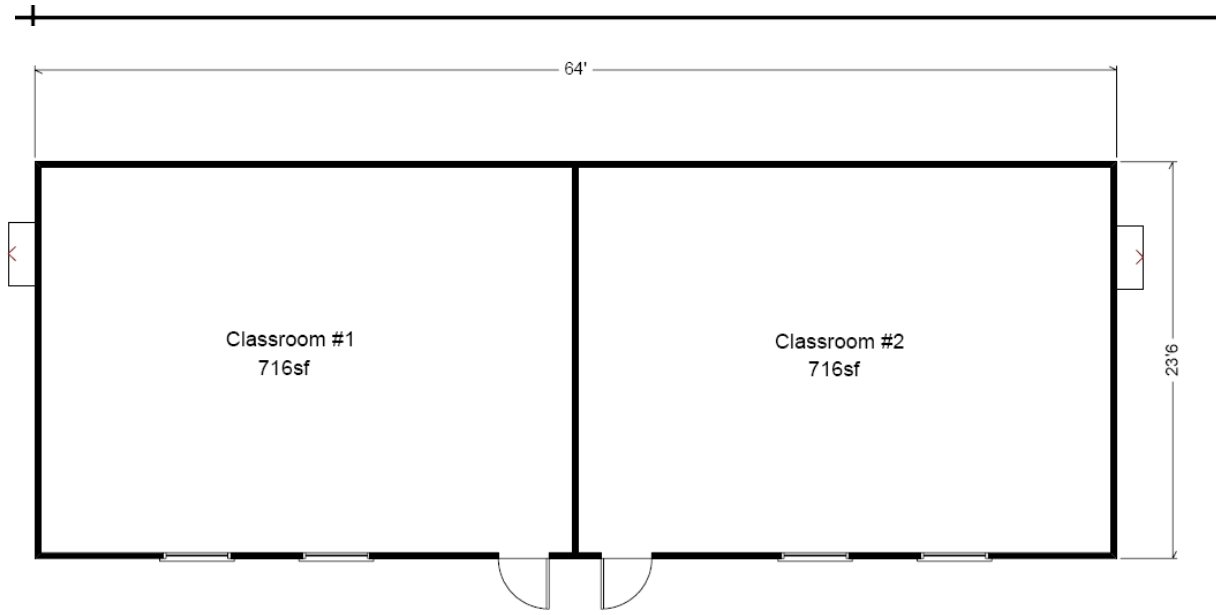
W. Hitch/Tires/Axles: Hitches will be removed and stored under building while tires and axles are to remain on the modules. Tires and axles will be removed only if necessary to complete the building installation due to site constraints and will also be placed under the modules.

1.5 Furniture, Fixtures, and Equipment (FF&E)

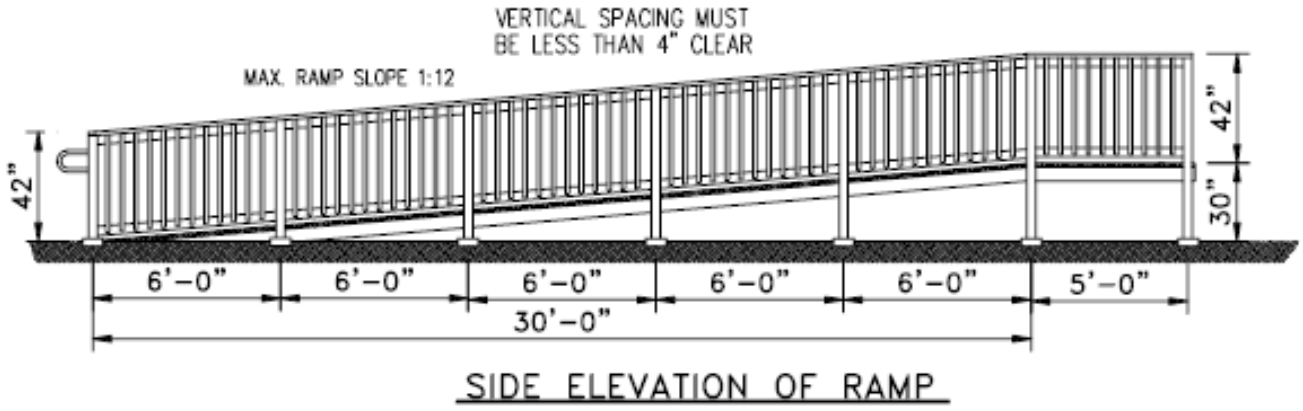
A. The Contractor shall furnish and set in place all FF&E items necessary for a functional classroom. The furniture may be provided by FBISD, but will be the full responsibility of the contractor to move to site and back to origin. These items should include, at a minimum: student desks and chairs, teacher desk and chair, one 4-drawer vertical file cabinet, one portable teacher storage cabinet for coat and other storage, student storage cubbies/shelving and coat hooks, and computer station desks and chairs.

1.6 Drawings

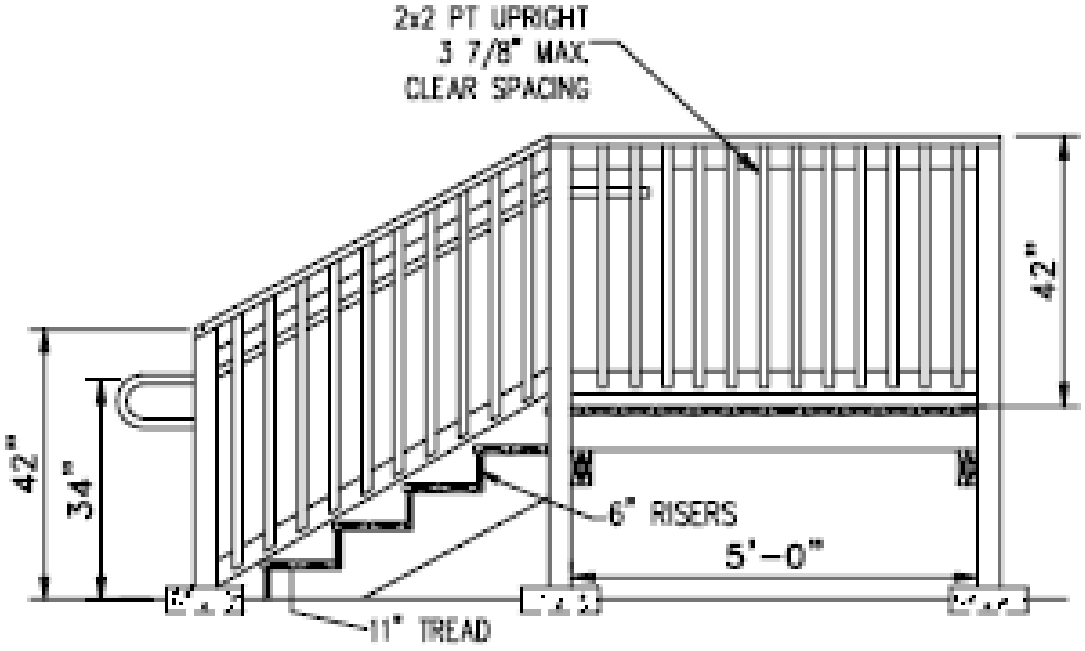
A. The following is a typical floor plan design guideline drawing:



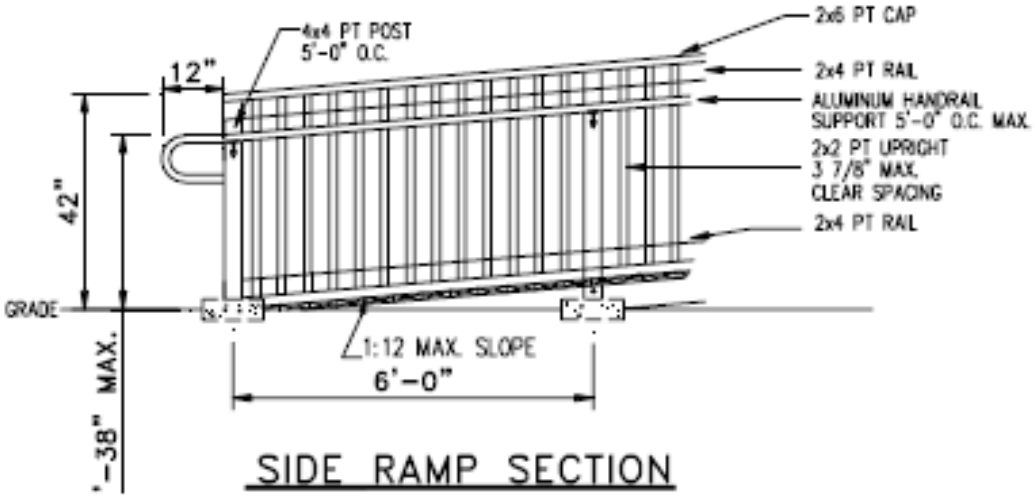
A. The following design guideline drawings are to be used for ramps/walkways:



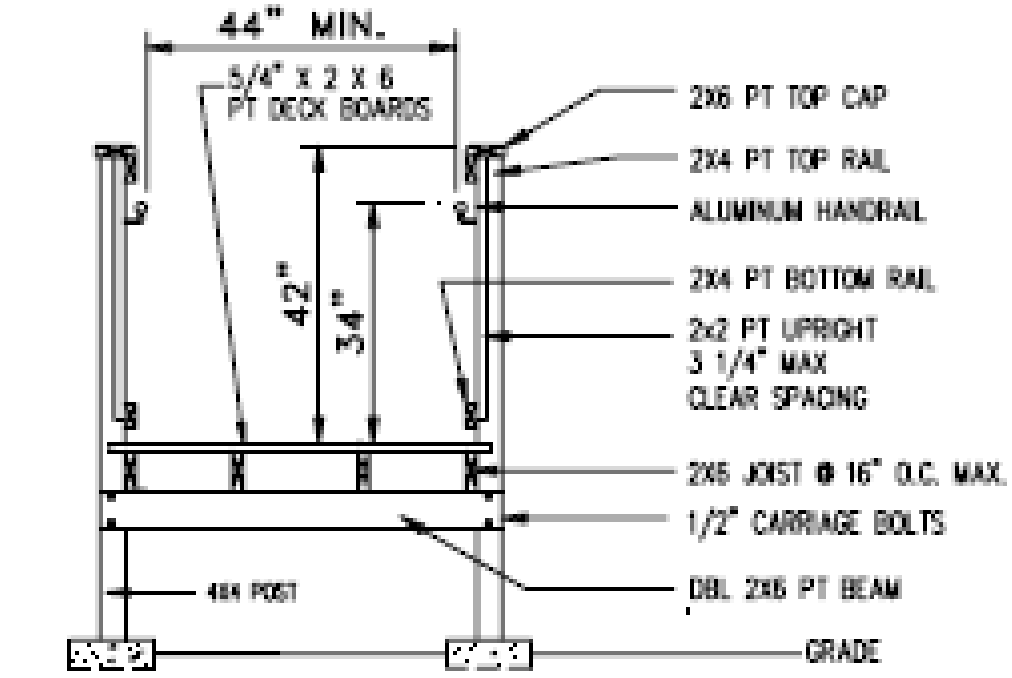
SIDE ELEVATION OF RAMP



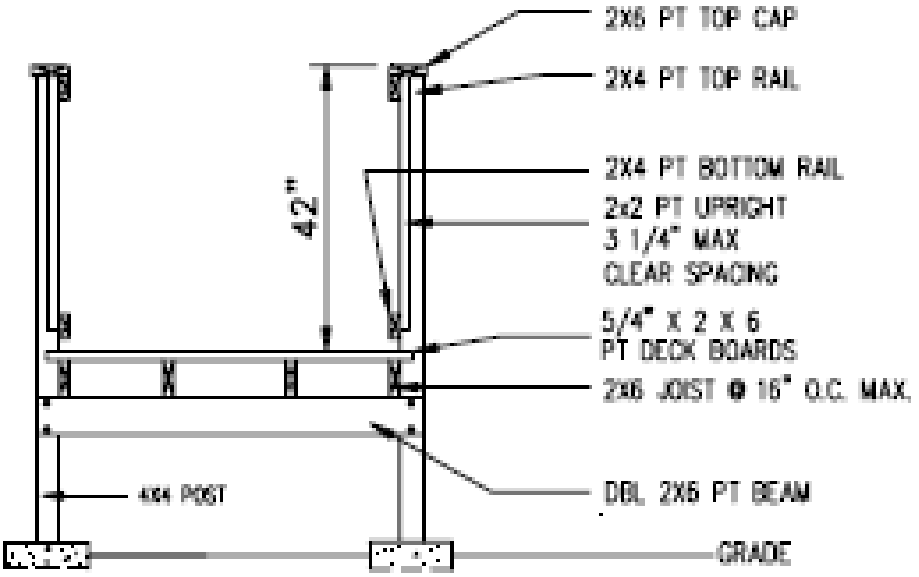
SIDE ELEVATION OF STEP



SIDE RAMP SECTION



STEP/RAMP SECTION



ELEV. WALKWAY SEC 'A'

End of Section 01 52 14

SECTION 01 55 13.10 - STABILIZED CONSTRUCTION ENTRANCE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction access points used during construction and until final development of the site.

1.2 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.3 REFERENCES

A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 P R O D U C T S

2.1 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632), and the equivalent opening size between 50 and 140.

C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.

D. Representative Manufacturers: Mirafi, Inc., or equal.

2.2 COARSE AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall be 2" to 5" in size. No crushed concrete will be allowed.

PART 3 E X E C U T I O N

3.1 PREPARATION AND INSTALLATION

A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner's Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Owner's Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction access points. Unless otherwise directed, maintain the stabilized construction roads and access points until the project is accepted by the Owner. Remove stabilized construction roads and access points promptly when directed by the Owner's Representative. Discard removed materials off site in accordance with the requirements of Division 1.

E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at location not in or adjacent to a stream or floodplain. Off-site disposal is the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local rules and regulations.

F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

G. Conduct all construction operation under this Contract in conformance with the erosion control practices described in Division 1.

3.2 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits, and truck washing areas when approved by Owner's Representative, of the sizes and locations where shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas which drain into a drainage system protected by erosion and sediment control measures.

D. Details for stabilized construction access points are shown on the Drawings. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.

E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

F. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

G. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet. The thickness shall not be less than 8 inches. The width shall not be less than the full width of all points of ingress or regress.

H. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction access points, except where shown otherwise on the Drawings.

I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.

J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the Owner's Representative. These methods include the following:
   1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches.
   2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.
   3. Steel Mats - Perforated mats placed across perpendicular support members.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.
B. Qualifications and requirements for use of flagmen.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price Contracts.
   1. Traffic control and regulation. Payment will be based on Contractor's Schedule of Values for traffic control and regulation. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public.
   2. Flagmen. Payments will be based on Contractor's Schedule of Values for flagmen.
   3. Refer to Division 1 for unit price procedures.
B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD).
B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.
C. Areas having jurisdiction feedback and comments related to traffic control.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.
B. Traffic control plan:
   1. If using traffic control plan contained in the Contract without modification no additional information required.
   2. If using a different traffic control plan, submit the plan for approval to the local Governing Jurisdiction, Owner and Engineer. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer. The Contractor is responsible for obtaining approval from the Governing entity if using an alternate plan.
C. Submit copies of approved lane closure permits issued by all governmental authorities via owners designated software.
D. Submit Schedules of Values for traffic control plan and flagmen within ~~30~~ 10 days following Notice to Proceed.
E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work via transmittal in owners designated software.

1.5 SUSTAINABLE DESIGN (LEED) REQUIREMENTS

A. New Schools shall be LEED Certified Projects.

1.6 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.

1. Uniformed Peace Officers may be:
   a. Sheriffs and their deputies;
   b. Constables and deputy constables;
   c. Marshals or police officers of an incorporated city, town or village; or
   d. As otherwise provided by Article 2.12, Code of Criminal Procedure.
2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:

1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
2. Speaks English. Ability to speak Spanish is desirable but not required.
3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 PRODUCTS

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

2.2 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 EXECUTIO0N

3.1 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.
B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Owner's Representative.
C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.
D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.
E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.
F. Do not obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.
G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by architect or Owner's Representative to maintain temporary driveway access to commercial and residential driveways.
H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.
I. Remove or cover existing signage and striping that conflict with construction activities or that may cause driver confusion.
J. Provide safe access for pedestrians along major cross streets.
K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.
L. Do not close more than two consecutive esplanade openings at a time without prior approval from Owner's Representative.

3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.
B. Monitor and control parking of construction personnel's vehicles in existing facilities. Provide a layout plan designating construction personnel parking for approval by owner's representative using submittal procedures in 01 33 00 in kahua. Maintain vehicular access to and through parking areas.
C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.3 FLARES AND LIGHTS

A. Provide lights or reflectors during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.
B. Confine construction traffic to designated haul routes.
C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the governmental agency having jurisdiction in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.
B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.
C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.
D. Unless otherwise approved by Owner’s Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.
E. Replace existing traffic control devices in Project area.
F. Owner’s Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the Owner.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise. All bridging provided for vehicular or equipment traffic will be approved by an engineer at contractor’s expense.
    1. Shore trench or excavation to support bridge and traffic.
    2. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
        a. Bridging is placed over existing bus routes,
        b. More than five percent of daily traffic is comprised of commercial or truck traffic,
        c. More than two separate plates are used for bridging, and
        d. When bridge is to be used for more than five consecutive days.
    3. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.
B. Repair damage caused by installation.
C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
   1. Multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
   2. Vehicular traffic must change lanes abruptly,
   3. Construction equipment must enter or cross vehicular traffic lanes and walks,
   4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
   5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
   6. Where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Owner's Representative. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to AHJ's or Owner's Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

End of Section 01 55 26

SECTION 01 55 26 - TRAFFIC CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Traffic control plan:
1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
2. If using a different traffic control plan, submit the plan for approval to the local Governing Jurisdiction, Owner and Engineer. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer. The Contractor is responsible for obtaining approval from the Governing entity if using an alternate plan.

C. Submit copies of approved lane closure permits issued by all governmental authorities.

D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.

E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

1.5 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.
1. Uniformed Peace Officers may be:
a. Sheriffs and their deputies;
b. Constables and deputy constables;
c. Marshals or police officers of an incorporated city, town or village; or
d. As otherwise provided by Article 2.12, Code of Criminal Procedure.

2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
2. Speaks English. Ability to speak Spanish is desirable but not required.
3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 P R O D U C T S

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

2.2 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 E X E C U T I O N

3.1 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.

B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Owner's Representative.

C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not to obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Owner's Representative to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutive esplanade openings at a time without prior approval from Owner's Representative.

3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.3 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the governmental agency having jurisdiction a minimum of 60 days in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Owner's Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the Owner.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic.

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
1. Bridging is placed over existing bus routes,
2. More than five percent of daily traffic is comprised of commercial or truck traffic,
3. More than two separate plates are used for bridging, and
4. When bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
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2. Vehicular traffic must change lanes abruptly,
3. Construction equipment must enter or cross vehicular traffic lanes and walks,
4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
6. Where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Owner's Representative. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Owner's Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the work, whether temporary or permanent construction.

B. Related Sections.

1. Division 01 Section “Temporary Facilities and Controls” for temporary site fencing.
2. Division 03 Section “Site Clearing” for removing existing trees and shrubs.
3. Division 32 Section “Turf and Grasses” for turf (lawn) and meadow planting, hydro seeding and erosion control materials.
4. Division 32 Section “Plants” for border edgings.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100 mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100 mm) size.

B. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a perimeter rigid fence established two (2) feet outside the tree dripline.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

C. Qualification Data: For qualified arborist and tree service firm.

D. Certification: For arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees are promptly and properly treated and repaired when damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

F. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.
B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
C. Pre-installation Conference: Conduct conference at Project Site.
    1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
        a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
        b. Enforcing requirements for protection zones.
        c. Arborist's responsibilities
        d. Field Quality Control.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
    1. Storage of construction materials, debris, or excavated material
    2. Parking vehicles or equipment
    3. Foot traffic
    4. Erection of sheds or structures
    5. Impoundment of water
    6. Excavation or other digging unless otherwise indicated
    7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
B. Do not direct vehicle or equipment exhaust toward protection zones.
C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 PRODUCTS

2.1 Materials

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter, and free of weeds, roots, and toxic and other non-soil materials.
    1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
B. Topsoil: Complying with plant material notes as indicated on the drawings.

C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
    1. Type: Pine Straw
    2. Color: Natural
    3. Application: Four (4) inches thick
D. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
    1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2 inch (50 mm) opening, 0.148 inch (3.76 mm) diameter wire chain-link fabric; with pipe posts, minimum 2 -318 inch (60 mm) OD line posts, and 2-718 inch (73 mm) OD comer and pull posts; with 1-518 inch (42 mm) OD top trails, with 0.177 inch (4.5 mm) diameter top tension wire and 0.177 inch (4.5 mm) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
    2. Height: 6 feet (1.8 m)
    3. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm)
E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
    1. Size and Text: 18”x 24”
    2. Lettering: 3 inch (75 mm) high minimum, white characters on red background

PART 3 EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do no enter or cross protection zones.
B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1 inch (25 mm) blue-vinyl tape around each tree trunk at 54 inches (1,372 mm) above the ground.
B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused be dewatering operations.
C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
    1. Apply 4 inch (100 mm) average thickness or organic mulch. Do not place mulch within 6 inches (150 mm) of tree trunks.

2. In those instances where a proposed vehicular drive occurs within the tree protection zone, 1 inch thick plywood shall be placed a top 6 inch thick organic mulch within the affected area. This application shall remain in place until roots within drive area are pruned under supervision of a licensed arborist for installation of pavement.

3.3 TREE AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Chain-Link Fencing: Install to comply with ASTMF567 and with manufacturer's written instructions.
   2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
   3. Access Gates: Install as described in Section 2.1.D.2; adjust to operate smoothly, easily and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption , or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet (10.5 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving".

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilizes. Cut roots as required for root pruning.
C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as directed and under the supervision of an arborist licensed in the jurisdiction of the construction activity.
B. Root pruning at Edge of Protection Zone: Pune roots as directed by arborist licensed in the jurisdiction of the construction activity.
C. Root Pruning within Protection Zone.

3.6 CROWN PRUNING

A. Prune branches that affected by temporary and permanent construction. Prune branches as directed by an arborist licensed in the jurisdiction of the construction activity.
    1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
    2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
    3. Cut branches with sharp pruning instruments; do not break or chop.
    4. Do not apply pruning paint to wounds.
B. Chip removed branches and dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
    1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   4. Perform repairs within 24 hours.
   5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable or restoring to normal growth pattern. Consult with Architect if tree is a live oak.
   1. Proved new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
   2. Provide two (2) new trees of 6 inch (150 mm) caliper size for each tree being replaced that measure more than 4 inches (100 mm) in caliper size.
      a. Species: All trees.
   3. Plant and maintain new trees as specified in Division 32 Section "Plants".

3.10 DISPOSAL OR SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

End of Section 01 56 39

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).

B. Implementation, maintenance, inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.

C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with the Owner's Representative prior to start of construction.

1.2 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:

1. Disturbs five acres or more, or
2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.

C. Small Construction Activity: Project that:

1. Disturbs one or more acres but less than five acres, or
2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.

D. TPDES Operator:

1. The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

1.3 SUSTAINABLE DESIGN (LEED) REQUIREMENTS

A. New Schools shall be LEED Certified Projects.

PART 2 PRODUCTS- Not Used

PART 3 EXECUTION

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following Part III of the Construction General Permit and the applicable local code. If conflicts exist between the Construction General Permit and the local regulations, the more stringent requirements will apply.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

3.2 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

A. Fill out, sign, and date TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000). Contractor shall provide NOI forms for both himself and Owner.
B. Transmit the signed Contractor's copy of TCEQ Form 20022, along with a check for the required fee, made out to Texas Commission on Environmental Quality.
C. Submission of the Notice of Intent form by the Contractor to TCEQ is required a minimum of fourteen days before Commencement of Construction Activities.

3.3 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, "Construction Site Notice."
B. Transmit the signed Construction Site Notice to the Engineer and Owner at least seven days prior to Commencement of Construction Activity.

3.4 CERTIFICATION REQUIREMENTS

A. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form.

3.5 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to the Owner's Representative.

3.6 REQUIRED NOTICES

A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
    1. Post the TPDES permit number for Large Construction Activity or a signed TCEQ Construction Site Notice for Small Construction Activity. A signed copy of the Contractor's NOI must also be posted.
    2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
        a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with the Owner's Representative to conform to requirements of the Construction General Permit.
        b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active

construction. Move notice as necessary.

3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.
4. Post a notice of waste disposal procedures in a readily visible location on site.

3.7 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.
B. Prepare list of waste material to be stored on-site. Update list as necessary to include up to- date information. Keep a copy of updated list with the SWP3.
C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.8 NOTICE OF TERMINATION

A. Submit a NOT to TCEQ and the Engineer within 30 days after:
    1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
    2. Another operator has assumed control over all areas of the site that have not been stabilized; and
    3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.

End of Section 01 57 10

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.
B. Protecting work against surface runoff and rising floodwaters.
C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

1.2 SUSTAINABLE DESIGN (LEED) REQUIREMENTS

A. New School Projects shall be LEED Certified Projects.

PART 2 MEASUREMENTS AND PAYMENT

2.1 UNIT PRICES

A. Measurement for control of ground water, if included in Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of well points, eductor wells, or deep wells.
B. If not included in Bid Form, include the cost to control ground water in unit price for work requiring such controls.
C. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.
D. Follow Division 1 for unit price procedures.

2.2 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3).
B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).
C. Storm Water Management Handbook for Construction Activities prepared by Cities having jurisdiction authority.

2.3 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
    1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
    2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.
B. Excavation drainage: includes keeping excavations free of surface and seepage water.

C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.
D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

2.4 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.
B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Division 2 to produce following results:
    1. Effectively reduce hydrostatic pressure affecting:
        a. Excavations.
        b. Tunnel excavation, face stability or seepage into tunnels.
    2. Develop substantially dry and stable subgrade for subsequent construction operations.
    3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work.
    4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata.
    5. Maintain stability of sides and bottom of excavations.
C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.
D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.
E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.
F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.
H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.
I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and

possible contaminant transport from contamination sources into work area or ground water control system.

2.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit Ground Water and Surface Water Control Plan for review by Owner's Representative prior to start of excavation work. Include the following:

1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control.
2. Names of equipment Suppliers and installation Subcontractors.
3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures.
4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization.
8. Excavation drainage methods including typical drainage layers, sump pump application and other means.
9. Surface water control and drainage installations.
10. Proposed methods and locations for disposing of removed water.

C. Submit following records upon completion of initial installation:

1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Baseline analytical test data of water from monitoring wells.
4. Initial flow rates.

D. Submit the following records weekly during control of ground and surface water operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells.

2.6 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.
C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.
D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 3 PRODUCTS

3.1 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner's Representative through submittals required in Paragraph 1.06, Submittals.
B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.
C. Maintain equipment in good repair and operating condition.
D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.
E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
    1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 4 EXECUTION

4.1 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.
B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.
C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.
D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.
F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.
G. Removal of ground water control installations.
    1. Remove pumping system components and piping when ground water control is no longer required.
    2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
    3. Remove monitoring wells when directed by Owner's Representative.
    4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.
H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.
I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50- foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.
J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.
K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.
L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.
M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

4.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For above ground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.
B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering

and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.
D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.
E. Replace installations that produce noticeable amounts of sediments after development.
F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.6B.

4.3 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan if required.
B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

4.4 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan if required.
B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.
C. Extend standpipe 12 inches to 18 inches above lip of pit.
D. Convey discharge of water pumped from standpipe to sediment trapping device.
E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

4.5 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

4.6 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.
B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.
C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.
D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner's Representative.

4.7 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also,

monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner's Representative determines more frequent monitoring and recording are required. Comply with Owner's Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

4.8 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

End of Section 01 57 19

SECTION 01 57 19 – TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising floodwaters.

C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

PART 2 MEASUREMENT AND PAYMENT

2.1 UNIT PRICES

A. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

2.2 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3).

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

2.3 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
   1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
   2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage: includes keeping excavations free of surface and seepage water.

C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.

D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

2.4 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Division 2 to produce following results:
   1. Effectively reduce hydrostatic pressure affecting:
      a. Excavations.
      b. Tunnel excavation, face stability or seepage into tunnels.
   2. Develop substantially dry and stable subgrade for subsequent construction operations.
   3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work.
   4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata.
   5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.

I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

2.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit Ground Water and Surface Water Control Plan for review by Owner’s Representative prior to start of excavation work. Include the following:
   1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control.
   2. Names of equipment Suppliers and installation Subcontractors.
   3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures.

4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization.
8. Excavation drainage methods including typical drainage layers, sump pump application and other means.
9. Surface water control and drainage installations.
10. Proposed methods and locations for disposing of removed water.

C. Submit following records upon completion of initial installation:
1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Baseline analytical test data of water from monitoring wells.
4. Initial flow rates.

D. Submit the following records weekly during control of ground and surface water operations:
1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells.

2.6 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 3 P R O D U C T S

3.1 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner’s Representative through submittals required in Paragraph 1.06, Submittals.

B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.

C. Maintain equipment in good repair and operating condition.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
   1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 4 E X E C U T I O N

4.1 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.

F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.

G. Removal of ground water control installations.
   1. Remove pumping system components and piping when ground water control is no longer required.
   2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
   3. Remove monitoring wells when directed by Owner's Representative.
   4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.

I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.

J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.

K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.

M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

4.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For above ground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.

B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.

D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.6B.

4.3 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan.

B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

4.4 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan.

B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.

C. Extend standpipe 12 inches to 18 inches above lip of pit.

D. Convey discharge of water pumped from standpipe to sediment trapping device.

E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

4.5 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

4.6 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.

D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner’s Representative.

4.7 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner’s Representative determines more frequent monitoring and recording are required. Comply with Owner’s Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

4.8 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Construction procedures to promote adequate indoor air quality after construction.
B. Building flush-out after construction and before occupancy.
C. Testing indoor air quality before commencement of construction; existing building areas only.
D. Testing indoor air quality after completion of construction.
E. Testing air change effectiveness after completion of construction.

1.2 PROJECT GOALS

A. New Schools shall be LEED Certified Projects.
B. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
    1. Cleaning of ductwork is not contemplated under this Contract.
    2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
    3. Establish condition of existing ducts and equipment prior to start of alterations.
C. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
    1. Furnish products meeting the specifications.
    2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.
D. Ventilation: HVAC system has been designed to achieve the minimum requirements for ventilation specified in ASHRAE 62.1.

1.3 RELATED REQUIREMENTS

A. LEED Certification Procedures: LEED credits relating to indoor air quality.
B. Section 01 40 00 - Quality Requirements: Testing and inspection services.
C. Section 23 41 00 – Particulate Air Filtration.

1.4 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.
B. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2013.
C. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).
D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2010.
E. SMACNA (OCC) - IAQ Guideline for Occupied Buildings Under Construction; 2007.

1.5 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
C. Particulates: Dust, dirt, and other airborne solid matter.
D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. LEED Submittals: Submit all submittals required in this section in accordance with procedures specified in Section 01 35 15.
C. NEW Construction or Additions - Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide.
    1. Submit not less than 60 days before enclosure of building.
    2. Identify potential sources of odor and dust.
    3. Identify construction activities likely to produce odor or dust.
    4. Identify areas of project potentially affected, especially occupied areas.
    5. Evaluate potential problems by severity and describe methods of control.
    6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
    7. Describe cleaning and dust control procedures.
    8. Describe coordination with commissioning procedures.
D. NEW Construction or Additions- Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
E. Duct and Terminal Unit Inspection Report.
F. Air Contaminant Test Plan: Identify:
    1. Testing agency qualifications.
    2. Locations and scheduling of air sampling.
    3. Test procedures, in detail.
    4. Test instruments and apparatus.
    5. Sampling methods.
G. Air Contaminant Test Reports: Show:
    1. Location where each sample was taken, and time.
    2. Test values for each air sample; average the values of each set of
    3. HVAC operating conditions.
    4. Certification of test equipment calibration.
    5. Other conditions or discrepancies that might have influenced results.
H. Ventilation Effectiveness Test Plan: Identify:
    1. Testing agency qualifications.
    2. Description of test spaces, including locations of air sampling.
    3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
    4. Test instruments and apparatus; identify tracer gas to be used.
    5. Sampling methods.

I. Ventilation Effectiveness Test Reports: Show:
   1. Include preliminary tests of instruments and apparatus and of test spaces.
   2. Calculation of ventilation effectiveness, E.
   3. Location where each sample was taken and time.
   4. Test values for each air sample.
   5. HVAC operating conditions.
   6. Other information specified in ASHRAE 129.
   7. Other conditions or discrepancies that might have influenced results.

1.7 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 3 years' experience in performing the types of testing specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.
B. Begin construction ventilation when building is substantially enclosed.
C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
   3. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.

F. Do not store construction materials or waste in mechanical or electrical rooms.
G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
    1. Inspect duct intakes, return air grilles, and terminal units for dust.
    2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
    3. Clean tops of doors and frames.
    4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
    5. Clean return plenums of air handling units.
    6. Remove intake filters last, after cleaning is complete.
H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
I. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT – REQUIRED FOR NEW CONSTRUCTION

A. Perform building flush-out before occupancy.
B. Do not start flush-out until:
    1. All construction is complete.
    2. HVAC systems have been tested, adjusted, and balanced for proper operation.
    3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
    4. New HVAC filtration media have been installed.
C. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot (4500 cubic meters per square meter) of floor area has been supplied.
    1. Obtain Owner's concurrence that construction is complete enough before beginning flush- out.
    2. Maintain interior temperature of at least 60 degrees F (15 degrees C) and interior relative humidity no higher than 60 percent.
    3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
    4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
        a. Begin ventilation at least three hours prior to daily occupancy.
        b. Continue ventilation during all occupied periods.
        c. Provide minimum outside air volume of 0.30 cfm per square foot (0.0015 cubic meters) or design minimum outside air rate, whichever is greater.
D. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.3 AIR CONTAMINANT TESTING – OWNER'S OPTION: NEW CONSTRUCTION

A. Perform air contaminant testing before starting construction, as base line for evaluation of post- construction testing.
B. Perform air contaminant testing before occupancy.
C. Do not start air contaminant testing until:
    1. All construction is complete, including interior finishes.
    2. HVAC systems have been tested, adjusted, and balanced for proper operation.
    3. New HVAC filtration media have been installed.
D. Indoor Air Samples: Collect from spaces representative of occupied areas:
    1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
    2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.
    3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
    4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
    5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
    6. When retesting the same building areas, take samples from at least the same locations as in first test.
E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
F. Analyze air samples and submit report.
G. Air Contaminant Concentration Determination and Limits:
    1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
    2. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
    3. Formaldehyde: Not more than 27 parts per billion.
    4. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.
    5. 4-Phenylcyclohexene (4-PCH): Not more than 6.5 micrograms per cubic meter.
    6. Particulates (PM10): Not more than 50 micrograms per cubic meter.
    7. Total Particulates (PM): Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.
    8. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

H. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

3.4 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.
B. Do not begin ventilation effectiveness testing until:
    1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
    2. Building flush-out or air contaminant testing has been completed satisfactorily.
    3. New HVAC filtration media have been installed.
C. Test each air handler zone in accordance with ASHRAE 129.
D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner.

End of Section 01 57 21

SECTION 01 57 23 – TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Division 1.

B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.

C. Filter Fabric Fences:
1. Type 1: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.
2. Type 2: Temporary reinforced filter fabric fences for erosion and sediment control in channelized flow areas.

D. Straw Bale Fence.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCE STANDARDS

A. ASTM
1. A 36 - Standard Specification for Carbon Structural Steel.
2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft3 (600 kN-m/m3)].
3. D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.
4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.4 SYSTEM DESCRIPTIONS

A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.

B. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.

C. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

D. Sediment traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturer’s catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

PART 2 P R O D U C T S

2.1 CONCRETE

A. Concrete: Class B in accordance with Division 32 or as shown on the Drawings.

2.2 AGREGATE MATERIALS

A. Use poorly graded cobbles with diameter greater than 2 inches and less than 5 inches.

B. Provide gravel lining in accordance with Division 31 or as shown on the drawings.

C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.3 PIPE

A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Division 33 or as shown on the Drawings.

B. Inlet Pipes: Galvanized steel pipe in accordance with Division 33 or as shown on the Drawings.

C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.4 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.

B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.

C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.

D. Mirafi, Inc., Synthetic Industries, or equivalent.

2.5 FENCING

A. Wire Fencing: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24 inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 x 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 12 inch bury and full height of filter fabric.

2.6 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
1. Minimum unit weight of four ounces per square yard.
2. Minimum grab strength of 100 psi in any principal direction (ASTM D4632).
3. Mullen burst strength exceeding 300 psi (ASTM D3786).
4. Ultraviolet stability exceeding 70 percent.
5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

2.7 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

PART 3 E X E C U T I O N

3.1 PREPARATION, INSTALLATION AND MAINTENANCE

A. Provide erosion and sediment control structures at locations shown on the Drawings.

B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manger to allow installation of erosion and sediment control systems, soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manger to remove and discard existing system.

D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Re-dress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Project Manger. Dispose of materials in accordance with Division 1.

E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Division 1.

F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Division 31.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.

H. Protect existing trees and plants in accordance with Division 1.

3.2 SEDIMENT TRAPS

A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.

B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.

C. Use fill material for embankment in accordance with Division 31.

D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.

E. Stone outlet sediment traps:
1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be a minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.

F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.

G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.3 FILTER FABRIC FENCE CONSTRUCTION METHODS

A. Fence Type 1
1. Install stakes 6 feet on center maximum and firmly embed minimum 12 inches in soil. If filter fabric is factory pre-assembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.
3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
5. Backfill and compact trench.

B. Fence Type 2
1. Layout fence same as for Type 1.
2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.

6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.

C. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.

D. Trench in toe of filter fabric fence with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

E. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

F. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.

G. Triangular Filter Fabric Fence Construction Methods:
1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
   a. Toe-in skirt 6 inches with mechanically compacted material;
   b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
   c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

H. Reinforced Filter Fabric Barrier Construction Methods:
1. Attach woven wire fence to fence stakes.
2. Securely fasten filter fabric material to wire fence with tie wires.
3. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.
4. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches, whichever is less.

3.4 DIKE AND SWALE

A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.

B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.

D. Clear in accordance with Division 31.

E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.5 DOWN SPOUT EXTENDER

A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Division 33.

3.6 PIPE SLOPE DRAIN

A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.

B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.

C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.

D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.

E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.7 PAVED FLUME

A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.

B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

C. Construct permanent paved flumes in accordance with Drawings.

D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.8 LEVEL SPREADER

A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.

B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.9 INLET PROTECTION BARRIER

A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET BASKET CONSTRUCTION METHODS.

A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.

B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.

C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.

D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 BRUSH BERM CONSTRUCTION METHODS

A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.

B. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.

C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.

D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.12 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Division 1.

B. In addition to stabilized construction access points, shovel or sweep pavements as required to keep areas clean. Do not water hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.13 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.14 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.15 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Division 1. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.16 WATER RUNOFF AND EROSION CONTROL

A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.

E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.

F. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   1. Hold area of bare soil exposed at one time to a minimum.
   2. Provide temporary controls such as berms, dikes, and drains.

G. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

H. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.

I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.

J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.

L. Do not damage existing trees intended to remain.

3.17 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Owner’s Representative.

B. Dispose of sediments and waste products following Division 1.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Sections:

1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "Substitution Procedures" for requests for substitutions.
4. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in “Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 10 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
    1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
    2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
    3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
    4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
    1. Store products to allow for inspection and measurement of quantity or counting of units.
    2. Store materials in a manner that will not endanger Project structure.
    3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.

4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   2. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.
C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product. Contractor to obtain approval for use of products listed.

B. Product Selection Procedures:
   1. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
   3. Manufacturers:
      b. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
      c. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 EXECUTION (Not Used)

End of Section 01 60 00

DIVISION 1 – GENERAL REQUIREMENTS
SECTION 01 61 16 – VOLATILE ORGANIC COMPOUND CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. VOC restrictions for product categories listed below under "DEFINITIONS."
B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.2 DEFINITIONS

A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
   1. Adhesives, sealants, and sealer coatings.
   2. Carpet.
   3. Carpet cushion.
   4. Carpet tile.
   5. Resilient floor coverings.
   6. Wood flooring.
   7. Paints and coatings.
   8. Insulation.
   9. Gypsum board.
   10. Acoustical ceilings and panels.
   11. Cabinet work.
   12. Student and teacher desks, tables, and chairs.
   13. Systems furniture and seating.
   14. Wall coverings.
   15. Composite wood and agrifiber products used either alone or as part of another product.
   16. Other products when specifically stated in the specifications.
B. Interior of Building: Anywhere inside the exterior weather barrier.
C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.3 REFERENCE STANDARDS

A. LEM - Low-Emitting Materials Product List; Collaborative for High Performance Schools
B. VOC - Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers
C. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.
D. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.
E. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

1.4 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.
    1. Identify evidence submittals with the words "LEED Report".
C. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.
D. Installer Certifications for Accessory Materials: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of their products, or 2) that such products used comply with these requirements.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified.
    1. Product data submittals showing VOC content are NOT acceptable forms of evidence.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
B. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

End of Section 01 61 16

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Installation of the Work.
   3. Cutting and patching.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

B. Related Sections:
   1. Division 01 Section "Submittal Procedures" for submitting surveys.
   2. *Division 02 Section* "*Selective Structure Demolition" for demolition and removal of selected portions of the building.*
   3. Division–07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching if not part of the original scope of work.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products to be used for patching and firms or entities that will perform patching work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect and district representative of locations and details of cutting. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that will result in increased maintenance or decreased operational life or safety. Operational elements may include the following but not be limited to:
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Mechanical systems piping and ducts.
   f. Control systems.
   g. Communication systems.
   h. Conveying systems.
   i. Electrical wiring systems.
   j. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, reduce their capacity to perform as intended, or that will result in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Equipment supports.
   e. Piping, ductwork, vessels, and equipment.
   f. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment when applicable.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect and owner for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, underground electrical services, and other utilities.
2. Furnish location data for work related to project that must be performed by public utilities serving project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the work, examine substrates, areas, and conditions, with installer or applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. *Proceed with installation only after unsatisfactory conditions have been corrected.* Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing utility information: Furnish information to local utility company that is necessary to adjust, move, or relocate existing utility structures, utility poles,

lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Space requirements: Verify space requirements and dimensions of items shown diagrammatically on drawings.
C. Review of contract documents and field conditions: Immediately on discovery of the need for clarification of the contract documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."
D. Surface and Substrate Preparation: Comply with manufacturer's recommendations for p reparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect or owner's representative promptly.
B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.
    1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
    2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
    3. Inform installers of lines and levels to which they must comply.
    4. Check the location, level and plumb, of every major element as the Work progresses.
    5. *Notify Architect when deviations from required lines and levels exceed allowable tolerances.*
    6. Close site surveys with an error of closure equal to or less than the standard stablished by authorities having jurisdiction.
C. Site Improvements: Locate and lay out site improvements, including pavements, grading, ill and topsoil placement, utility slopes, and rim and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and owner's representative. Submit log at project completion for project records.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cut the work using methods that are least likely to damage work to be retained or adjoining work. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even- plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.
6. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.
B. Coordination: Coordinate construction and operations of the work with work performed by owner's construction personnel.
   1. Construction Schedule: Inform owner of contractor's preferred construction schedule for owner's portion of the work. Adjust construction schedule based on a mutually agreeable timetable. Notify owner or owner’s representative fourteen (14) days prior to the start of owner’s contractor if changes to schedule are required due to differences in actual construction progress.
   2. Pre-installation Conferences: Include owner's construction personnel at pre-installation conferences covering portions of the work that are to receive owner's work. Attend pre- installation conferences conducted by owner's construction personnel if portions of the work depend on owner's construction.

3.7 PROGRESS CLEANING

A. General: *Clean Project site and work areas daily, including common areas.* Enforce requirements strictly. Dispose of materials lawfully.
   1. Provide necessary daily cleaning during construction to maintain premises and adjoining public properties free from construction waste, debris and rubbish, and dust caused by operations.
   2. At completion of each day, remove waste materials and rubbish; store tools, equipment, machinery and surplus materials; and clean all sight exposed surfaces.
   3. If Contractor fails to clean up each day and at the completion of his Work, the Owner may do so and charge the cost thereof to the Contractor. At his next pay application a deductive change order will be processed and there is no appeal for back charges due to clean up.
   4. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   5. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg. F.
   6. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Utilize containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Cleaning Materials: Use only cleaning materials recommended by manufacturer of the surface to be cleaned. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to insure freedom from damage and deterioration at time of Substantial Completion.

H. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective

covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, whether completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

L. During Construction:
   1. Oversee cleaning and ensure that building(s) and ground(s) are maintained free from accumulations of waste materials and rubbish.
   2. Sprinkle dusty debris with water.
   3. During progress of Work, clean-up site and access and dispose off waste materials, rubbish and debris at least once every week.
   4. Provide dump containers and locate on site for collection of waste materials, rubbish and debris on a daily basis.
   5. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
   6. Remove waste materials, rubbish and debris from site and legally dispose off at public or private dumping area.
   7. Lower waste materials in controlled manner with as few handlings as possible; do not drop or throw materials from heights.
   8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
B. Restore permanent facilities used during construction to their specified condition.
C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

End of Section 01 73 00

SECTION 01 74 16 - SITE MAINTENANCE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.3 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Division 1.

B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.4 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of work in an area.

B. Phased Construction:
1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Pavement, Sidewalks and Driveways: Materials specified in Division 32.

B. Seeding and Sodding: Sod specified in Division 32.

C. Trees, Shrubs and Plantings: Conform to requirements of Division 1.

PART 3 E X E C U T I O N

3.1 SITE PROJECTS

A. Contractor shall maintain a clean and orderly site throughout construction duration. Work includes but is not limited to: insuring grass is mowed and kept at a manageable height, trash is continuously picked up and construction materials are stored in an orderly fashion.

B. Contractor shall immediately repair and restore any damage done to adjoining properties such that final conditions are as equal to or better than prior to damage occurring.

3.2 WORK IN PUBLIC ROW

A. Contractor shall repair and replace any damaged items in the Public ROW to the satisfaction of the local governing authority.

3.3 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Division 1.

3.4 LANDSCAPING AND FENCES

A. Seeding and Sodding.
   1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
   2. Restore previously existing turfed areas with sod and fertilize in accordance with Division 32. Sod to match existing turf.
   3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Division 32.

B. Trees, Shrubbery and Plants.
   1. Remove and replant trees, shrubs, and plants in accordance with requirements of Division 1.

C. Fence Replacement.
   1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.
   2. Remove and dispose of damaged or substandard material.

3.5 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

B. Refer to Division 1 for maintenance requirements.

END OF SECTION

SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.2 SUBMITTALS

A. Conform to requirements of Division 1.

B. Contractor shall obtain all required permits prior to disposal of excess material in areas designated as being in "100-year Flood Hazard Area."

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Division 1.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into Owner's designated trucks.

C. Pipe Culvert: Load culverts designated for salvage into Owner's designated trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on Owner's trucks with Owner's Representative.

F. The Contractor shall dispose of all items the Owner refuses in conformance with the requirements of Division 1 at no additional cost to the Owner.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless a permit has

been obtained. Remove excess material placed in "100-year Flood Hazard Area" without a permit, at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
    1. Substantial Completion.
    2. Final Completion.
    3. Warranties.
    4. Final cleaning.

B. Related Sections:
    1. Division 01 Section "Execution" for progress cleaning of Project site.
    2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
    3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
    4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
    5. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.
    6. Forms located at the end of this Section 01 77 00:
        a. GC Closeout Checklist
        b. Conditional Waiver and Release on Final Payment
        c. Unconditional Waiver and Release on Final Payment
        d. Warranty Form
        e. Asbestos Free Letter Form
        f. Lead Free Letter Form
        g. PCB Free Letter Form

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion Certificate:
    1. Before requesting inspection for determining date of Substantial Completion, complete the requirements listed on the GC Closeout Checklist. Establish the date when the work is complete.
    2. Prepare a list of items to be completed and corrected (punch list), the value of item on the list, and reasons why the Work is not complete.
    3. Ensure required parties have accepted the work and executed the certificate.
    4. Advise the Owner of pending insurance changeover requirement.
    5. Grant the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits and similar releases.

6. Complete startup, commissioning, testing, manufacturer requirements, and corrections of all systems.
7. Establish the start date for the warranties.
8. Establish the completion of the contract time in order to determine if liquidated damages apply.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, the items listed in 1.3 of this section must be complete. The Contractor must also complete the items listed in the attached "General Contractor Closeout Checklist" at the end of this section.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
    1. Organize list of spaces in sequential order.
    2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
    3. Include the following information at the top of each page:
        a. Project name.
        b. Date.
        c. Name of Contractor.
        d. Page number.
    4. Submit list of incomplete items in the following format:
        a. PDF electronic file.
        b. Projects using the owner's designated software will require the punch list information to be input on an excel spread sheet. The example of the sheet is at the end of this specification section.

1.6 WARRANTIES

A. Submittal Time: All warranties shall commence on the date of substantial completion unless noted otherwise. Exceptions will have to be approved by architect and owner's representative and notes made on the AIA substantial completion document.
B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
    1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
    2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document. Coordinate paragraph below if Division 01 Section "Operation and Maintenance Data" is used.

Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Remove tools, construction equipment, machinery, and surplus material from Project site.
   d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   f. Sweep concrete floors broom clean in unoccupied spaces.
   g. Vacuum carpet and similar soft surfaces, removing debris and

excess nap; shampoo if visible soil or stains remain.

h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
i. Remove labels that are not permanent.
j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
p. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

End of Section 01 77 00

General Contractor - Closeout Checklist

Not Applicable Items are to be Noted in the Remarks Column

Template Revised
8/10/2022

To: <<Name>>, Director of Design and Construction **Date:**
GC: **A/E Firm:**
BP#: **PM:**
School Name:

Project Type: ☐ Addition ☐ Renovations ☐ New Construction

Item #	Document Description	Primary Responsibility	Date Received by PM	Remarks
	SUBSTANTIAL COMPLETION REQUIREMENTS - Closeout and Punch List Items are NOT to be billed at Substantial Completion			
a.	Fire Alarm System Components Completed	GC		
b.	Local Fire Marshal Approval Certificate	GC		
c.	HVAC Air and Water Balancing Completed	GC		
d.	Energy Management Systems Completed	GC		
e.	Communications Equipment and Telephone Systems Completed	GC		
f.	Final Lockset Cores Installed	GC		
g.	Room Plaques and Exterior Signage Completed	GC		
h.	Owner Demonstrations and Training Completed	GC		
i.	Exterior Clean-up and Landscaping Completed	GC		
j.	Final Interior Clean-up Completed	GC		
k.	Certificate of Occupancy	GC		
l.	Punch List Report	GC, A/E		
	FINAL COMPLETION REQUIREMENTS: CLOSEOUT ITEMS TO BE SUBMITTED WITH FINAL PAYMENT - Allowed billable amount on G702: 100% of contract			
1	**SUBSTANTIAL COMPLETION**			
a.	Certificate of Substantial Completion	PM		
b.	Signed Off Punchlist	GC		
2	**WARRANTIES**			
a.	List of Subcontractors and Suppliers	GC		Include Name, Address, Phone Number and Discipline
b.	Contractor's 1 year Warranty	GC		
c.	Subcontractors' 1 year Warranties	GC		
d.	Manufacturers' Warranties	GC		A separate "Warranties" manual should be provided for guarantees, warranties, etc.
3	**EVIDENCE OF PAYMENT OF DEBTS AND CLAIMS**			

Item #	Document Description	Primary Responsibility	Date Received by PM	Remarks
a.	"Contractor's Affidavit of Payment of Debts and Claims" (Confirm GC and Sub Lien Waivers are attached to form.)	GC		
b.	"Contractor's Final Affidavit of Release of Liens"; (Confirm GC and Sub Lien Waivers are attached to form.)	GC		
c.	"Consent of Surety Company to Final Payment"; (Confirm that Power of Attorney is attached to form.)	GC		
4	**INSURANCE**			
a.	Certificate(s) of Insurance, All insurance must be maintained for one year following substantial completion	GC		
b.	Written Statement that the Contractor Knows of no Substantial Reason that the Insurance will not be Renewable to Cover the Required Period	GC		
5	**OPERATIONS AND MAINTENANCE MANUALS AND EVIDENCE OF TRAINING**			
a.	O&M Manuals submitted by GC to A/E	GC		Per detailed list developed by GC and reviewed by A/E and PM. One Manual per each school to be split by CSI Divisions. Electronic Copy and 1 Hard Copy.
b.	Training Matrix, Sign-In sheet(s) and Videos.	GC		GC is to provide a sign-in sheet for each system for which training has been provided to indicate the person, title and date of completion of the training. 1 digital copy of Training Videos.
6	**ATTIC STOCK / SPARE MATERIAL / KEY TRANSFER**			
a.	Signed off Transmittal of Extra (Attic) Stock	GC		Provided by GC and received by Principal or Campus Facilities Supervisor or Maintenance, as applicable
b.	Signed off Transmittal Key transfer (Accessory keys)	GC		Provided by GC and received by Principal or Campus Facilities Supervisor, as applicable.
7	**LOCAL AGENCIES APPROVALS (as applicable)**			
a.	Certificate of Occupancy	GC		
b.	Final Building Inspections/Closed Construction Permits	GC		Green tags colored copies
c.	State Fire Marshal's Fire Alarm Inspection Certificate & Testing	GC		
d.	Storm Water Prevention Pollution Plan (SWPPP)	GC		
e.	Elevator Inspection Certificate	GC		
f.	Boiler Inspection Certificate	GC		
g.	Health Department Inspection Certificate	GC		
8	**RECORD DOCUMENTS (DRAWINGS, SPECIFICATIONS, ETC.)**			
a.	Record Documents, Submit 1 Hard Copies and 1 PDF Copy	GC		
9	**GC DESIGNED DOCUMENTS (as applicable)**			
a.	Fire Alarm drawings	GC		Need AHJ approved documents.
b.	Security drawings	GC		Need AHJ approved documents (if applicable)
c.	HVAC Controls drawings	GC		
d.	Fire Sprinkler System drawings	GC		Need AHJ approved documents.

Item #	Document Description	Primary Responsibility	Date Received by PM	Remarks
e.	Data Cabling drawings	GC		
10	**CERTIFICATIONS**			
a.	Certification of Asbestos Free Project: Letter from GC and **A/E**, Letters from Subs	GC, A/E		
b.	Certification of Lead-Free Potable Water System: Letters from GC and Subs	GC		
c.	Certification of PCB-Free Project: Letters from GC and Subs	GC		
11	**FINAL SYSTEM REPORTS**			
a.	Final Test & Balance Report	T&B		
b.	Final Roof Inspection Report	Roof Inspector		
12	**LEED CONSTRUCTION SUBMITTAL**			
a.	Sustainable Sites *SSp1* - Construction Activity Pollution Prevention: **Erosion & Sedimentation Control Plan**	GC		
b.	Materials and Resources *MRp2 & MRc5* - Construction Waste Management: **Const. Waste Mgmt. Plan**	GC		
c.	Materials and Resources *MRc3* - Sourcing of Raw Materials: **Building Product Disclosure & Optimization Calculator (BPDO)**	GC		
d.	Environmental Quality *EQc3* - **IAQ Management Plan for Construction and Preoccupancy Phases**	GC		
e.	Environmental Quality *EQc2* - Low Emitting Materials: **Low Emitting Materials Calculator**	GC		
13	**FINAL COMPLETION**			
a.	Copy of Final Change Order	A/E, GC, PM		
b.	TEA - Certification of Project Compliance	A/E, GC, FBISD, PM		
c.	TAS/TDLR Certification (if applicable)	AE		
d.	Complete Set of Approved Submittals Log from Prolog	GC		Include Prolog Summary Log in Binder
e.	Final Completion Certificate	A/E, GC, PM		
	RETAINAGE			
a.	FBISD Retention Release Reduction Worksheet	PM		
b.	Purchase Order Closure	PC		
	WARRANTY INSPECTIONS			
a.	11 month inspection after Date of Substantial Completion	PM		

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CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job No. _____

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Title)

==========

NOTE: Section 53.281(b)(2), Texas Property Code, requires that the above form be notarized. See Chapter 121, Texas Civil Practice & Remedies Code, regarding Acknowledgments & Proofs of Written Instruments, or consult an attorney. For short acknowledgement forms that might be suitable, see Section 121.008 in Chapter 121. Click here to go there.

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NOTICE:

This document waives rights unconditionally and states that you have been paid for giving up those rights. It is prohibited for a person to require you to sign this document if you have not been paid the payment amount set forth below. If you have not been paid, use a conditional release form.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job No. _____

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____(owner) located at _____(location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____(Company name)

By _____(Signature)

_____(Title)

==========

NOTE: Section 53.281(b)(2), Texas Property Code, requires that the above form be notarized. See Chapter 121, Texas Civil Practice & Remedies Code, regarding Acknowledgments & Proofs of Written Instruments, or consult an attorney. For short acknowledgement forms that might be suitable, see Section 121.008 in Chapter 121. Click here to go there.

WARRANTY LETTER

PLEASE PRINT ON YOUR COMPANY LETTERHEAD

WARRANTY FOR:

Fort Bend ISD BOND 2023:

We, the undersigned, hereby warrant that Work described above which we have furnished and/or installed for the following project:

PROJECT TITLE: Job # _____,

PROJECT ADDRESS:

_____

The project is in accordance with the Contract Documents, including guaranteeing all of the work under the contract to be free from faulty materials in every particular, and free from improper workmanship, and against injury except from proper and usual wear and tear; and agreeing to replace or re-execute without cost to the Owner such work as may be found to be improper, imperfect or of unsatisfactory material and/or workmanship, without cost to the Owner, and to make good all damage caused to other work or materials, or to the Owner's property, real and personal, due to such improper, imperfect or faulty material and/or workmanship, and/or due to the required replacement or re-execution. Such warranty periods shall be maintained notwithstanding that certain systems may be activated prior to Substantial Completion as required for the satisfactory completion of the project. This guarantee shall be made to cover a period of one (1) year from the date of Substantial Completion as certified by the Architect under this Contract.

CONTRACTOR:

Company Name: _____

By:_____
(Signature)

_____
(Contact Name & Title)

_____
(Address)

_____
(Phone Number)

(PROJECT NAME) ASBESTOS FREE AFFIDAVIT
FBISD PROJECT NO:

ASBESTOS FREE AFFIDAVIT

I understand that the Fort Bend Independent School District, in order to protect the students, staff and public in general from any unnecessary exposure to asbestos fibers, and to comply with the Asbestos Hazard Emergency Response Act prohibits the use of asbestos containing materials in all forms in the construction and operation of their facilities.

I certify that I am familiar with the materials used in the construction of, and incorporated into, the construction described below. I further certify that to the best of my knowledge and belief, no asbestos containing building materials (ACBM) either friable or otherwise were used in the process of construction or incorporated into the construction of the building.

CAMPUS LOCATION:

SCOPE OF WORK: _____

SPECIFICATION SECTION(S): _____

SUBCONTRACTOR: _____

_____ _____
General Contractor's Signature Date

_____
General Contractor's Printed Name & Title

Failure to complete this waiver constitutes non-compliance with the job specifications and an unacceptable job.

Signed before me this ___ day of _____, 20____

Notary Public: _____

My commission expires: _____

As the architect and/or project engineer responsible for the above said project I certify that no asbestos containing building materials were specified as a building material in the building as specified in 40 CFR 763.99(a)(7).

_____ _____

_____ _____ _____ _____
Architect's or Project Engineer's Stamp Signature Date

(PROJECT NAME) LEAD FREE AFFIDAVIT
FBISD PROJECT NO:

LEAD FREE AFFIDAVIT

I understand that the Fort Bend Independent School District, in order to protect the students, staff and public in general from any unnecessary exposure to Lead, and to comply with the U.S. Code for a "LEAD FREE" drinking water system. "No person may use any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, after June 19, 1986, in the installation or repair of- (i) any public water system; or (ii) any plumbing in a residential or nonresidential facility providing water for human consumption, that is not LEAD FREE (within the meaning of subsection (d) of this section). [42 USC§ 300g-6]"

I certify that I am familiar with the materials used in the construction of, and incorporated into, the construction described below. I further certify that to the best of my knowledge and belief, no lead containing building materials were used in the process of construction or incorporated into the construction of the drinking water system in the building.

CAMPUS(ES):

SCOPE OF WORK: _____

SPECIFICATION SECTION(S): _____

SUBCONTRACTOR: _____

_____ _____
General Contractor's Signature Date

_____
General Contractor's Printed Name & Title

Failure to complete this waiver constitutes non-compliance with the job specifications and an unacceptable job.

Signed before me this ___ day of _____, 20____

Notary Public: _____

My commission expires: _____

As the architect and/or project engineer responsible for the above said project I certify that no lead containing building materials were specified as a building material in the building as specified in 42 U.S. Code§ 300g-l - National drinking water regulations.

_____ _____
Architect's or Project Engineer's Stamp Signature Date

(PROJECT NAME)
FBISD PROJECT NO: PCB FREE AFFIDAVIT

PCB FREE AFFIDAVIT

I understand that the Fort Bend Independent School District, in order to protect the students, staff and public in general from any unnecessary exposure to polychlorinated biphenyls (PCB's), and to comply with the U.S. Environmental Protection Agency's recommendation for schools to eliminate PCB containing building material in all forms in the construction and operation of their facilities. I certify that I am familiar with the materials used in the construction of, and incorporated into, the construction described below. I further certify that to the best of my knowledge and belief, no polychlorinated biphenyls containing building materials (PCBs) were used in the process of construction or incorporated into the construction of the building.

CAMPUS(ES):

SCOPE OF WORK: _____

SPECIFICATION SECTION(S): _____

SUBCONTRACTOR: _____

_____ _____
General Contractor's Signature Date

_____
General Contractor's Printed Name & Title

Failure to complete this waiver constitutes non-compliance with the job specifications and an unacceptable job.

Signed before me this ___ day of _____, 20____

Notary Public: _____

My commission expires: _____

As the architect and/or project engineer responsible for the above said project I certify that no PCB containing building materials were specified as a building material in the building as specified in 40 CFR 761.20.

_____ _____
Architect's or Project Engineer's Stamp Signature Date

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Product maintenance manuals.
   4. Systems and equipment maintenance manuals.

B. Related Sections:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 02 Section “Demonstration and Training” for instructing Owner’s personnel in the maintenance of the products and in the operation of equipment and systems.
   3. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or sub-systems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect and owner’s representative.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable ~~inserted~~ reviewer comments on draft submittals.
   2. One (2) paper copy and (2) electronic copies on separate usb devices delivered at substantial completion.
   3. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 calendar days before commencing demonstration and training. Architect

will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion. Architect will return copy with comments.
   1. Correct or modify each manual to comply with Architect and owner's representative Comments. Submit copies of each corrected manual within 10 days of receipt of Comments and prior to commencing demonstration and training.

PART 2 PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
    1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
    1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
    2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.
F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
    1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
        a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
        b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of content. Indicate volume number for each of the three required multiple-volume sets.
    2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
    3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
    1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
    2. Performance and design criteria if Contractor is delegated design responsibility.
    3. Operating standards.
    4. Operating procedures.
    5. Operating logs.
    6. Wiring diagrams.
    7. Control diagrams.
    8. Piped system diagrams.
    9. Precautions against improper use.
    10. License requirements including inspection and renewal dates.
B. Descriptions: Include the following:
    1. Product name and model number. Use designations for products indicated on Contract Documents.
    2. Manufacturer's name.
    3. Equipment identification with serial number of each component.
    4. Equipment function.
    5. Operating characteristics.
    6. Limiting conditions.
    7. Performance curves.
    8. Engineering data and tests.
    9. Complete nomenclature and number of replacement parts.
C. Operating Procedures: Include the following, as applicable:
    1. Startup procedures.
    2. Equipment or system break-in procedures.
    3. Routine and normal operating instructions.
    4. Regulation and control procedures.
    5. Instructions on stopping.
    6. Normal shutdown instructions.
    7. Seasonal and weekend operating instructions.
    8. Required sequences for electric or electronic systems.
    9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation and diagram controls as installed.
E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
B. Source Information: List each product included in the manual, identify them by product name, and arrange to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
C. Product Information: Include the following, as applicable:
    1. Product name and model number.
    2. Manufacturer's name.
    3. Color, pattern, and texture.
    4. Material and chemical composition.
    5. Reordering information for specially manufactured products.
D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
    1. Inspection procedures.
    2. Types of cleaning agents to be used and methods of cleaning.
    3. List of cleaning agents and methods of cleaning detrimental to product.
    4. Schedule for routine cleaning and maintenance.
    5. Repair instructions.
E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identify by product name and arrange to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section

number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Provide transmittal from district's construction management software for transmittance of extra parts.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.1 MANUAL PREPARATION

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
    1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
    2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
    1. Do not use original project record documents as part of operation and maintenance manuals.
    2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

End of Section 01 78 23

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Sections:
   1. Division 01 Section "Execution" for final property survey.
   2. Division 01 Section "Closeout Procedures" for general closeout procedures.
   3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.
   2. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal: Submit one paper copy set as well as PDF electronic files of marked-up record prints and two sets of plots from corrected record digital data files on a single usb device. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal: Submit one paper copy set, a PDF electronic files of marked-up record prints on a single usb device.

B. Record Specifications: Submit as PDF electronic file of Project's Specifications, including addenda and contract modifications on a single usb device.

C. Record Product Data: Submit as PDF electronic file of each approved submittal.
   1. Submit where record Product Data are required as part of operation and maintenance manuals. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy set as well as PDF electronic files of each submittal.

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, submit marked- up record prints to Architect. The Architect will then prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark specifications to indicate the actual product installation where installation varies from that indicated in specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as a paper copy as well as in scanned PDF electronic file(s) of marked up paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as a paper copy as well as scanned PDF electronic file(s) of marked up paper copy.
    1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

PART 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

End of Section 01 78 39

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.
   4. O&M Manuals should be uploaded into Owner’s designated software (Kahua)

B. Related Sections:
   1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies with closeout documentation per section 01 77 00 closeouts.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date of video recording.
   2. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A qualified representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations. Provide a minimum (14) day advanced notice.
B. Coordinate instructors, including providing notification of dates, times, length of instruction time, a nd course content.
C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
B. Training Modules: Develop a learning objective and teaching outline for each module. For each module, include instruction for the following as applicable to the system, equipment, or component:
    1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
        a. System, subsystem, and equipment descriptions.
        b. Performance and design criteria if Contractor is delegated design responsibility.
        c. Operating standards.
        d. Regulatory requirements.
        e. Equipment function.
        f. Operating characteristics.
        g. Limiting conditions.
        h. Performance curves.
    2. Documentation: Review the following items in detail as applicable:
        a. Emergency manuals.
        b. Operations manuals.
        c. Maintenance manuals.
        d. Project record documents.
        e. Identification systems.
        f. Warranties and bonds.
        g. Maintenance service agreements and similar continuing commitments.
    3. Emergencies: Include the following, as applicable:
        a. Instructions on meaning of warnings, trouble indications, and error messages.
        b. Instructions on stopping.
        c. Shutdown instructions for each type of emergency.
        d. Operating instructions for conditions outside of normal operating limits.
        e. Sequences for electric or electronic systems.
        f. Special operating instructions and procedures.
    4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with r equirements in Division 01 Section "Operations and Maintenance Data."
B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish an instructor to describe Owner's operational philosophy.
   2. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner’s representative with at least 14 days advance notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect and owner’s representative.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

End of Section 01 77 00

SECTION 01 80 10 - MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Provide necessary work and services required for the complete installation of heating, ventilating, air conditioning, plumbing, and electrical systems in the buildings as shown on the Drawings. For convenience, Drawings showing primarily HVAC have been numbered with an “M”, Drawings showing primarily electrical have been numbered with an “E” and Drawings showing; primarily plumbing have been numbered with a “P”.

B. Make installations in a manner that shall comply with applicable codes and laws. Where the requirements of Contract Documents exceed code requirements, comply with the Contract Documents.

C. Perform electrical Work in accordance with the latest edition of the national Electrical code as minimum standards of quality and safety.

D. Comply with: (ADA) Americans Disability Act and (TAS) Texas Accessibility Standards requirements.

1.2 RELATED REQUIREMENTS

A. Section 01 73 29 – Cutting and Patching.

B. Section 01 31 19 – Project Meetings.

C. Section 01 30 00 – Administrative Requirements.

D. Section 01 33 00 – Submittal Requirements.

E. Section 01 60 00 – Product Requirements: Product options and substitutions.

F. Section 01 70 00 – Execution and Closeout Requirements.

1.3 REQUIREMENTS FOR EQUIPMENT

A. Provide equipment with necessary parts and accessories even though the parts and accessories are not specifically mentioned herein.

B. Provide a factory applied finish on all exterior surfaces. Tough up or refinish items which have the finish marred, before final acceptance.

C. Rotating parts shall be in static and dynamic balance.

D. Electrical materials shall bear the stamp of approval of the Underwriter’s Laboratory.

E. Noise: Eliminate any abnormal noises, which are not an inherent part of the systems as designed. Abnormal buzzing and rattling of equipment, piping, ducts, and air devices and squeaks in rotating equipment components will not be acceptable.

1.4 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to jobsite until progress of construction has reached the stage where equipment is actually needed, or until equipment can be stored inside building to

protect equipment from the weather. Equipment allowed to stand in weather will be rejected, and new equipment of a like kind shall be used.

B. Adequately protect equipment from damage after delivery to job site. Cover with heavy drop cloths as required to protect from plaster, dirt, paint, water, adverse weather conditions, and physical damage.

C. Equipment which has been damaged by construction activities will be rejected, and new equipment of a like kind shall be used.

D. At time of Substantial Completion, equipment shall be clean.

E. Insulation material that becomes wet shall be rejected and replaced at no additional cost to Owner.

1.5 OPERATING MANUALS, SERVICE DATA, AND WARRANTIES

A. Upon completion of the project, provide service manuals for each type unit of equipment provided in the project as described in Section 01 70 00 – Execution and Closeout Requirements.

B. Warranties: In addition to the one year warranty specified in the Conditions of the Contract, assume all responsibility for special guarantees which may be required in this specification concerning installation, operation or performance of equipment, materials, and systems provided by a distributor, manufacturer or subcontractor.

1.6 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures, Supplementary Conditions and individual specification sections.

B. Equipment and material submittals shall show sufficient data to indicate complete compliance with Contract Documents as follows:
1. Proper sizes and capabilities.
2. Ability to fit in the available space in a manner that will allow proper service.
3. Construction methods, materials, and finishes.
4. List of accessories.

C. Product data shall include the contract item designation, building, and proposed model number.

D. If proposed air devices are different than models specified, indicate the specified model and beside it the proposed model for each type of device. Do not list quantities.

E. For any item to be installed in or on a finished surface (such as a tee bar, acoustical ceiling, plaster wall) certify that applicable Contract Documents have been checked and that the item submitted is compatible with the surface finish on which it is to be installed.

F. Show Drawings: Sheet metal, piping, mechanical, and electrical fabrication Shop Drawings shall show equipment, ductwork, and piping, including piping in plumbing chases, sized and drawn in exact location to be installed. Produce Drawings in 1/4 inch scale with all ductwork and piping sized accordingly. Ductwork and piping larger than 3 inches shall be shown with double lines.

G. Coordination Drawings: Coordination Drawings are Drawings which indicate relationships between the various systems and other components of the building such as beams,

columns, ceilings, and walls. They shall be drawn to 1/4 inch scale and shall include plans, elevations, sections, and other details as required to clearly define the relationships of the various components. Indicate ducts, conduits, sprinkler systems, light fixtures, piping, and miscellaneous equipment on one drawing for each floor or level. Refer to Mechanical and Electrical Specifications for additional requirements. Submit these within two months of award of contract.

H. Interference Drawings:
1. Interference Drawings are supplementary to Coordination Drawings and indicate conflict between the various systems and other components of the building such as beams, columns, and walls. They shall be drawn to 1/4 inch scale and shall include plans, elevations, sections, and other details as required to clearly define the interference and to indicate the Contractor's proposed solution.

2. Submit Drawings for approval whenever job measurements and an analysis of the Drawings and specifications by the Contractor indicate that the various systems cannot be installed without significant deviation from the intent of the Contract. When such an interference is encountered, Work shall cease in the general areas of the conflict until a solution to the question has been approved by the Architect.

I. All Submittals shall be bound into book form with a table of contents listing all items in that specific submittal. Loose catalog sheets or drawings will not be acceptable. A separate brochure will be required for each type of equipment; e.g., lighting fixtures, switchgear, lighting panels, clock system, mechanical equipment, plumbing items, and ductwork accessories, each in a separate brochure. Miscellaneous apparatuses such as transformers contactors, time switches, and safety switches may be contained in one brochure.

J. Auxiliary system submittals shall contain sufficient information to show conformance with the specifications and shall include a description of the operation of each system to aid the consultant in the evaluation of each submittal.

PART 2 – PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTIONS AND SUPERVISION

A. Follow manufacturer's directions for installation, testing, and operation of all apparatuses and equipment provided.

B. Where supervision by a manufacturer is required in the specification, pay all costs and follow all instructions and recommendations of the manufacturer, who shall supervise the installation, connection, startup adjustment, instruction of the Owner, and final tests of equipment and systems. Where two or more manufacturer's equipment is interrelated, coordinate the Work and supervision.

C. Provide a letter from the manufacturers whose supervision is required stating that they have supervised the installation and their equipment or system is operating satisfactorily in detail and in every respect and that the Owner's representative has been instructed in the operation and maintenance.

3.2 COORDINATION

A. Coordinate the mechanical and electrical Work with that of other trades in order that the various components of the systems shall be installed at the proper time, shall fit the available space, and shall allow proper service access to those requiring maintenance,

including equipment specified in other Divisions.

B. Remove and relocate items which are installed without regard to proper access as directed by the Consultant, at no additional cost to the Owner.

C. Provide materials with trim to match and fit properly with the types of adjacent ceiling, wall, and floor finishes actually installed. Model numbers in specifications or scheduled on Drawings are not intended to designate the required trim.

D. Provide mechanical equipment with electrical characteristics compatible with that shown on Electrical Drawings and described in electrical Division of the specifications.

E. Prior to the fabrication of ductwork or the installation of devices in the ceilings, review the Drawings to ascertain that the locations of devices in the ceilings create a pattern which is compatible with the reflected ceiling plan and the spacings of the various ceiling mounted devices.

3.3 DRAWINGS

A. The Contract Drawings are schematic in nature, but indicate how the various components are integrated with other parts of the building. Determine exact locations by job measurement, by checking the requirements of other trades, and by review of Contract Documents.

B. The Drawings indicate general routing of the various parts of the systems, but do not indicate all sizes, fittings, offsets, and runouts which are required. Provide correct sizes, fittings, offsets, and runouts required to fit the system into spaces allocated to them. Locate all light fixtures, vents, and supply grilles to conform to the ceiling grid system. Examine the Drawings to become familiar with this requirement.

C. In certain instances, the Architect may require relocation of outlets and switches. Where relocation is within 3 feet of location shown on Drawings, and when Contractor is informed of necessary relocation before Work is begun on this portion of the job, no extra compensation will be allowed.

END OF SECTION

SECTION 01 81 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference.
2. Pre-Installation Conferences.
3. Coordination Meetings.
4. Progress Meetings.

B. Construction schedules are specified in another Division-1 Section.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule.
2. Critical Work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.
6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Office, Work and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures.
13. First aid.
14. Security.
15. Housekeeping.
16. Working hours.

1.4 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of

manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

B. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
   1. Contract Documents.
   2. Options.
   3. Related Change Orders.
   4. Purchases
   5. Deliveries.
   6. Shop Drawings, Product Data and quality control Samples.
   7. Possible conflicts.
   8. Compatibility problems.
   9. Time schedules.
   10. Weather limitations.
   11. Manufacturer's recommendations.
   12. Compatibility of materials.
   13. Acceptability of substrates.
   14. Temporary facilities.
   15. Space and access limitations.
   16. Governing regulations.
   17. Safety.
   18. Inspection and testing requirements.
   19. Required performance results.
   20. Recording requirements.
   21. Protection.

C. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.

D. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

A. Conduct progress meetings at the Project sites once a week, or biweekly as the stage of work dictates. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning,

coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

    1. Review the present and future needs of each entity present, including such items as:
        a. Interface requirements.
        b. Time.
        c. Sequences.
        d. Deliveries.
        e. Off-site fabrication problems.
        f. Access.
        g. Site utilization.
        h. Temporary facilities and services.
        i. Hours of Work.
        j. Hazards and risks.
        k. Housekeeping.
        l. Quality and Work standards.
        m. Change Orders.
        n. Documentation of information for payment requests.

E. Reporting: No later than 3 days after each progress meeting date, the contractor shall distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

    1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 82 10 - NOTIFICATION OF ARCHITECT REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. In general, the Contractor shall notify the Architect whenever there is need of clarification of interpretation of the Contract Documents.

B. The Contractor shall notify the Architect 48 hours in advance of certain stages of construction. The project superintendent shall notify the Owner's Representative on an ongoing basis of ongoing work. These stages shall include, but not necessarily be limited to the following:

1. Division 2 – Demolition of any existing facilities or site features.

2. Division 3.
   a. Excavation of grade beams.
   b. Installation of concrete underlayment, underslab vapor barriers, water proofing.
   c. Installation of reinforcing and formwork
   d. Placing of concrete.

3. Division 4
   a. Placing of masonry, grout, and reinforcement
   b. Block, brick, and stone placement, glass unit masonry, masonry cleaning.

4. Division 5
   a. Erection of structural steel, open web steel joists, and steel deck.
   b. Miscellaneous metals, ladders, brackets, pipe rails, etc.

5. Division 6 - Finish Carpentry and Millwork.

6. Division 7
   a. Installation of waterproofing, vapor barriers, flashing and sheet metal.
   b. Installation of roofing system(s) and associated work.
   c. Concealment of insulation.
   d. Application of fireproofing.
   e. Installation of firestopping and firesafing.
   f. Installation of building and glazing sealants.

7. Division 8
   a. Installation of doors, frames, windows, and storefronts.
   b. Installation of rolling and coiling doors and grilles.
   c. Installation of finish hardware.
   d. Installation of glazing and glazed systems.

8. Division 9
   a. Installation of plaster and gypsum board products.
   b. Installation of tile, flooring, and pavers.
   c. Installation of acoustical ceiling (grid and panels).
   d. Installation of resilient flooring and base.
   e. Painting and staining (each coat).

9. Division 10
    a. Installation of specialty items, markerboards, display cases, projection screens, signage and graphics, canopies.
    b. Installation of operable walls and folding partitions.
    c. Installation of toilet accessories.

10. Division 11
    a. Installation of appliances.
    b. Installation of Stage Equipment.

11. Division 14 – Installation of elevators.

12. Division 21
    a. Installation of sprinkler piping.
    b. Installation of sprinkler heads.

13. Divisions 22, 23 and 26
    a. Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
    b. Any testing specified for mechanical, electrical and plumbing systems.
    c. Inspection and testing of underground utilities.

14. Division 22 - Installation of plumbing fixtures.

15. Division 23 - Installation of heating, ventilating and air conditioning.

16. Division 26 - Installation of all electrical fixtures.

17. Division 31
    a. Site clearing and stripping of top soil.
    b. Excavation for building foundation.
    c. Placing and compaction of each lift of select fill material.
    d. Drilling of foundation piers.
    e. Covering of underground utilities.
    f. Site grading.

18. Division 32
    a. Stabilization of paving subgrades.
    b. Installation of concrete paving.
    c. Installation of running track subgrade, base, and wearing course.
    d. Installation of athletic turf.
    e. Installation of decorative metal fencing.
    f. Installation of topsoil.
    g. Installation of landscaping.

PARTS 2 and 3 - Not Used

END OF SECTION

SECTION 01 83 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section also apply to mechanical and electrical installations, as well as work specified in Divisions 2 through 32. Refer to Division-23 and Division-26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
    a. Foundation construction.
    b. Bearing and retaining walls.
    c. Structural concrete.
    d. Structural steel.
    e. Lintels.
    f. Structural decking.

g. Miscellaneous structural metals.
h. Equipment supports.
i. Piping, ductwork, vessels and equipment.
j. Structural systems of special construction in Division-13.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
   a. Shoring, bracing, and sheeting.
   b. Primary operational systems and equipment.
   c. Air or smoke barriers.
   d. Water, moisture, or vapor barriers.
   e. Membranes and flashings.
   f. Fire protection systems.
   g. Noise and vibration control elements and systems.
   h. Control systems.
   i. Communication systems.
   j. Conveying systems.
   k. Electrical wiring systems.
   l. Special construction specified by Division-13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
   a. Matched-veneer woodwork.
   b. Preformed metal panels.
   c. Window wall system.
   d. Acoustical ceilings.
   e. Finished wood flooring.
   f. Carpeting.
   g. Aggregate wall coating.
   h. Wall covering.
   i. HVAC enclosures, cabinets or covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if

unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
2. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and

refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
5. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 02 07 00 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition of portions of existing buildings, site structures, and paving indicated on the Drawings and as required to accommodate new construction.
   2. Removal and protection of existing fixtures, materials, and equipment items.

B. Related Sections:
   1. Cutting concrete floors and masonry walls for piping, ducts, and conduits is included with the work of the respective fire suppression, plumbing, mechanical and electrical specification sections in Divisions 21, 22, 23, 26, 27, and 28.
   2. Cutting holes in roof deck for installation of new rooftop mechanical equipment is provided under Division 23.
   3. Remodeling construction work and patching are included within the respective sections of technical specifications, including removal of materials for reuse and incorporation into remodeling or new construction.
   4. Relocation of pipes, conduits, ducts, and other mechanical and electrical work is provided under their respective Sections.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Schedule indicating proposed sequence of operations for selective demolition work to Owner's Representative for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
      a. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
      b. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed new addition.
   2. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. Deliver copies of digital files to the Owner and Architect prior to start of work.

1.4 JOB CONDITIONS

A. Occupancy: Owner may occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

C. Conditions existing at time of inspection for bidding purposes will be maintained by

Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

D. Partial Demolition and Removal: Owner maintains first right of salvage. Items indicated to be removed but of salvageable value to Contractor, and not required to be salvaged for Owner, may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
   1. Storage or sale of removed items on site will not be permitted.

E. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
   1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.
   2. Erect temporary covered passageways as required by authorities having jurisdiction.
   3. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
   4. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
   5. Protect floors with suitable coverings when necessary.
   6. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
   7. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
   8. Remove protections at completion of work.

F. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

G. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
   1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

H. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

I. Explosives: Use of explosives will not be permitted.

J. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
   1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
   2. Maintain fire protection services during selective demolition operations.

K. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
   1. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

B. Cover and protect furniture, equipment, and fixtures from soiling or damage when demolition work is performed in areas where such items have not been removed.

C. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
   1. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation.
   2. Provide weatherproof closures for exterior openings resulting from demolition work.

D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
   1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
   1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
   2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
   3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
   4. Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
   5. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
   6. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.
   7. Completely remove any indicated slabs-on-grade and related foundations. Where drilled footings are encountered, remove footings to 24” below existing grade, and stake locations.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 SALVAGED MATERIALS

A. Salvaged Items: Owner maintains first right of salvage. When directed by Architect or Owner, carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

3.5 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

B. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 02 41 13.10 - REMOVING EXISTING PAVEMENTS, UTILITIES AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.

C. Removing pipe culverts, sewers and water lines.

D. Removing existing inlets and manholes.

E. Removing miscellaneous structures of concrete or masonry.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

B. Include cost of installing suitable backfill material and proper compaction (95% of the Std. Proctor Density) in cost of each item to be removed. No separate pay for this item.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Obtain advance approval from Engineer for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

3.2 PROTECTION

A. Protect the following from damage or displacement:
   1. Adjacent public and private property.
   2. Trees, plants, and other landscape features designated to remain.
   3. Utilities designated to remain.
   4. Pavement and utility structures designated to remain.
   5. Bench marks, monuments, and existing structures designated to remain.

3.3 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of two (2) inches.

D. Where street and driveway saw cut locations coincide or fall within three (3) feet of existing construction or expansion joints, break out to existing joint.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch thick masonry plug in pipe end prior to backfill.

G. When removing existing utilities or structures, all existing backfill material (i.e. cement stabilized sand) shall also be removed. Include in price of utility or structure removed.

3.4 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Division 31.

B. Trench and structure excavations shall be backfilled in 8” lifts and compacted to 95% of the Std. Proctor Density. Reference Geotechnical Report and Plans for details on acceptable backfill.

3.5 DISPOSAL

A. Inlet frames, grates, plates, and manhole frames and covers may remain property of the Owner. Disposal shall be in accordance with requirements of Division 1.

B. Remove from the site debris resulting from work under this section in accordance with requirements of Division 1.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

D. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.

E. Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

E. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

F. PS 1 - Structural Plywood; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

2.2 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.

2. Composition: Colorless, reactive, water-based compound.

3. Products:

a. Kaufman Products Inc; FormKote Emulsion: www.kaufmanproducts.net/#sle.

b. Nox-Crete Inc; BIO-NOX: www.nox-crete.com/#sle.

c. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.

d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

1. Products:

a. BoMetals, Inc: www.bometals.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Obtain approval before framing openings in structural members that are not indicated on drawings.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3. FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 31 63 29 - Drilled Concrete Piers and Shafts: Reinforcement for drilled pier foundations.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI MNL-66 - ACI Detailing Manual; 2020.

C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

E. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2019, with Editorial Revision.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

G. CRSI (DA4) - Manual of Standard Practice; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301.

1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel Mat: ASTM A704/A704M, using ASTM A615/A615M, Grade 60 (60,000 psi) steel bars or rods, unfinished.

C. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

D. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.

1. Form: Flat Sheets.

2. WWR Style: As indicated on drawings.

E. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. (Heavy duty chairs for slab on grade).

3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.2 RE-BAR SPLICING

A. Coupler Systems: Mechanical devices for splicing reinforcing bars.

1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.

2. Products:

a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com.

b. Splice Sleeve North America, Inc; NMB Splice Sleeve System: www.splicesleeve.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for splicing reinforcing bars.

1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.

2. Products:

a. Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-in: www.daytonsuperior.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.

1. Products:

a. Dayton Superior Corporation; A58 sure Plug: www.daytonsuperior.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

1. Products:

a. Dayton Superior Corporation; Sleeve-Lock Grout: www.daytonsuperior.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

1. Review locations of splices with Architect.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as indicated on drawings.

E. Bond and ground all reinforcement to requirements of Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

3.3 SCHEDULES - SEE DRAWINGS

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete for composite floor construction.

B. Floors and slabs on grade.

C. Concrete foundation walls.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads and equipment pits.

F. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

G. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

H. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

L. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm 2 in. Cube Specimens); 2023.

M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

N. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.

O. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

P. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

Q. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

R. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

S. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

T. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

U. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

V. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

W. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

X. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.

Z. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.

F. Test Reports: Submit report for each test or series of tests specified.

G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

1. Products:

a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

3. Products:

a. Henry Company; Moistop Ultra 15: www.henry.com.

b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com.

c. Poly-America; Husky ellow Guard Class A 15-mil Vapor Barrier: www.yellowguard.com.

d. Stego Industries, LLC; 15 mil: www.stegoindustries.com.

e. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.

f. Substitutions: Not permitted.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

a. Maximum: Plus 4 percent.

b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 5000 pounds per square inch.

4. Flowable Products:

a. Euclid Chemical Company; NS GROUT: www.euclidchemical.com.

b. Five Star Products, Inc; Five Star Fluid Grout 100: www.fivestarproducts.com.

c. Kaufman Products Inc; SureGrout: www.kaufmanproducts.net.

d. US Spec, an Oldcastle brand; MP Grout: www.usspec.com/#sle.

e. Substitutions: See Section 01 60 00 - Product Requirements.

5. Low-Slump, Dry Pack Products:

a. Euclid Chemical Company; DR PACK GROUT: www.euclidchemical.com.

b. Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com.

c. SpecChem, LLC; SC Multipurpose Grout: www.specchemllc.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

1. Products:

a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com.

b. Kaufman Products Inc; SureBond: www.kaufmanproducts.net.

c. Kaufman Products Inc; SureWeld: www.kaufmanproducts.net.

d. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com.

e. W. R. Meadows, Inc; ACR -LOK-: www.wrmeadows.com.

f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.

2. Products:

a. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com.

b. Dayton Superior Corporation; Slow Set Bonding Agent: www.daytonsuperior.com.

c. Kaufman Products Inc; SurePoxy HM EPL: www.kaufmanproducts.net.

d. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: www.specchemllc.com.

e. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com.

f. Substitutions: See Section 01 60 00 - Product Requirements.

C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2. Products:

a. Nomaco, Inc; Nomaflex Expansion Joint Filler with Void Cap Option: www.nomaco.com.

b. W. R. Meadows, Inc; Fiber Expansion Joint Filler with Snap-Cap: www.wrmeadows.com.

c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

1. Products:

a. W. R. Meadows, Inc; Speed-E-Joint: www.wrmeadows.com.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.

2. Height: To suit slab thickness.

3. Manufacturers:

    a. BoMetals, Inc: www.bometals.com.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

1. Manufacturers:

    a. BoMetals, Inc; QuicDowel: www.bometals.com.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Plate Dowel System: Steel plate dowel and plastic dowel sleeve; with integral fasteners for attachment to formwork.

1. Manufacturers:

    a. BoMetals, Inc: www.bometals.com.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.7 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

1. Product dissipates within 4 to 6 weeks.

2. Provide product containing fugitive red dye.

3. Products:

    a. Dayton Superior Corporation; Resin Cure with Dye J11WD: www.daytonsuperior.com.

    b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com.

    c. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net.

    d. Mapei Corporation; Mapecure DR: www.mapei.com/#sle.

    e. Sinak Corporation; Cure3D: www.sinak.com/#sle.

    f. US Spec, an Oldcastle brand; Maxcure Wax White: www.usspec.com/#sle.

    g. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com.

    h. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.

2. Water-Cement Ratio: Maximum as indicated on drawings percent by weight.

3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.

4. Maximum Slump: 4 inches.

5. Maximum Aggregate Size: 5/8 inch.

2. MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

2. Use latex bonding agent only for non-load-bearing applications.

D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.4 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

3.5 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for compliance with specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.

2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.

3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.

4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.6 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thick Floor Coverings: Wood float as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

2. Surfaces to Receive Thin Floor Coverings: Steel trowel as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.7 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

b. Spraying: Spray water over floor slab areas and maintain wet.

3. Final Curing: Begin after initial curing but before surface is dry.

a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3. DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.11 SCHEDULE - CONCRETE TYPES AND FINISHES - SEE DRAWINGS.

END OF SECTION 03 30 00

SECTION 03 31 00 - CONCRETE CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cutting and patching of existing concrete floor slabs including new cast-in-place concrete, formwork, reinforcing, mix designing, placement procedures, and finishes.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 02 -7 00 – Selective Demolition.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect/Engineer. Vapor retarder data shall be submitted and shall include perm ratings expressed in “grains / (ft squared x hr x in.Hg)”.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Include all special reinforcement on elevation drawn at a scale of not less than 1/4" to 1'-0". Original contract drawings shall not be reproduced for use as a portion of the Shop drawing.

D. Shop Drawings; Construction Joints: Submit original shop drawings indicating the proposed construction joint locations to the Architect/Engineer at least 14 days prior to beginning formwork on the portion of the building in question.

E. Concrete Mix Design: Submit mix designs and aggregate analysis of each class of concrete. Designs shall be submitted a minimum of 48 hours prior to the placement of any concrete.
   1. Mix designs shall include material proportions, material weights, material sources, manufacturer's data on any admixture used, and proof that the design meets the requirements of this specification.
   2. Proof shall include the water/cement ratio, slump, and the compressive strengths from concrete test cylinders. Substantive data may be taken from historical records or independent laboratory tests.
   3. Manufacturer's data shall include recommended dosages.
   4. Aggregate analysis shall include the sieve analysis, dry rodded unit weight of coarse aggregate, and the specific gravities of both fine and coarse aggregates.

F. Material certificates in lieu of material laboratory test reports when permitted by Architect/Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

G. Testing Reports: The independent testing laboratory shall submit laboratory test reports for concrete materials directly to the Architect/Engineer with copy to others in accordance with the provisions of section 01400 "Quality Control Services." State in each report whether or not the test specimens comply to the specified requirements, and indicate any deviations therefrom.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
   2. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, & Placing Concrete"
   3. ACI 305 "Hot Weather Concreting".
   4. ACI 306 "Recommended Practice for Cold Weather Concreting"
   5. ACI 311 "Recommended Practice for Concrete Inspection"
   6. ACI 318 "Building Code Requirements for Reinforced Concrete."
   7. ACI 347 "Recommended Practice for Concrete Formwork"
   8. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Mix designs: Test in accordance with the requirements of PART 2 - PRODUCTS, article "PROPORTIONING AND MIX DESIGNS".

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Deformed Bar Anchors: ASTM A 706.

F. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
   1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.2 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I. Type III cement may be used in lieu of Type I at contractor's option, when acceptable to the Architect/Engineer.
   1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
   2. Fly Ash: ASTM C 618, Class F.
   3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
   1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling. Do not use aggregates containing soluble salts or other substrates such as iron sulfides, pyrite, marcasite or ocher which can cause stains on exposed concrete surfaces.
   2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect/Engineer.

C. Water: Potable.

D. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

   1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
      a. MB-VR or Micro-Air, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
      b. Air-Tite, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
      c. Air-Mix or Perma-Air, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
      d. Darex AEA or Daravair, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
      e. Sika AER, Sika Corporation, USA 800-933-7452 www.sikaconstruction.com
      f. Sealtight AEA, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

F. Water-Reducing Admixture: ASTM C 494, Type A.

   1. Products: Subject to compliance with requirements, product which may be incorporated in the Work include, but are not limited to, the following:
      a. Pozzolith Normal or Polyheed, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
      b. Chemtard, ChemMasters Corp. 800-486-7866 www.chemmasters.net
      c. PSI N, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
      d. Eucon WR-75, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
      e. WRDA, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
      f. Metco W.R., Metalcrete Industries 800-526-5602 www8.inetba.com
      g. Prokrete-N, Prokrete Industries
      h. Plastocrete 161, Sika Corporation, USA 800-933-7452 www.sikaconstruciton.com

G. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
   1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
      a. Super P, Anti-Hydro International, Inc. 800-777-1773 www.anti-hydro.com
      b. Rheobuild or Polyheed, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
      c. Cormix 200, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
      d. Eucon 37, Euclid Chemical Company 800-321-7628 www.euclidchemical.com

e. WRDA 19 or Daracem, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
f. Superslump, Metalcrete Industries 800-526-5602 www8.inetba.com
g. PSPL, Prokrete Industries
h. Sikament 300, Sika Corporation, USA 800-933-7452 www.sikaconstruciton.com

H. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
a. Pozzutec 20, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
b. Lubricon NCA, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
c. Q-Set, Dayton Superior 888-977-9600 www.daytonsuperior.com
d. Accelguard 80, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
e. Daraset, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
f. Accel-Set, Metalcrete Industries 800-526-5602 www8.inetba.com

I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
a. Pozzolith R, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
b. PSI-R Plus, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
c. Eucon Retarder 75, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
d. Daratard-17, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
e. Protard, Prokrete Industries.
f. Plastiment, Sika Corporation, USA 800-933-7452 www.sikaconstruction.com

2.3 RELATED MATERIALS

A. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
1. For Expansion joints: Provide 6"x3/8"x3/4" split flange center bulb type waterstops, minimum.
2. For Cold joints: Provide 4"x3/16"x1/2" dumbbell type, endbell style, minimum.

B. Rubber Waterstops: Corps of Engineers CRD-C 513.
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
a. Meadow Burke 877-518-7665 www.meadowburke.com
b. Progress Unlimited, Inc. 800-777-7664 www.progress-unlimited.com
c. Williams Products, Inc. 800-423-1456 www.williamsproducts.com

C. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
a. Greenstreak 800-325-9504 www.greenstreak.com
b. Meadow Burke 877-518-7665 www.meadowburke.com
c. Progress Unlimited, Inc. 800-777-7664 www.progress-unlimited.com
d. The Schlegel Group 585-427-7200 www.schlegel.com
e. Vinylex Corporation 800-624-4435 www.vinylex.com
f. W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

D. Preformed Plastic Adhesive Waterstops: Federal Specification SS-S-210A. It shall be supplied in extruded form of suitable cross-section and of a size to seal the joint areas of concrete sections.

The plastic waterstop shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half, to facilitate application of the sealing compound.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

    a. Waterstop-RX, American Colloid Company 800-276-2737 www.colloid.com
    b. Synko-Flex, Henry Company 800-486-1278 www.henry.com
    c. Ram-Nex, K.T. Snyder Company, Inc.

E. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154 and is in compliance with ASTM E 1745 (class A) as follows:

1. Polyethylene sheet not less than 10 mils thick (must provide proof of compliance with ASTM E 1745).
2. Submittals shall indicate vapor retarder Permeance (Perm Rating) expressed in the following terms: grains/(ft^2 *hr * in.Hg).
3. Provide manufacturer's recommended mastics and gusset tape at all joints, to create a continuous membrane.
4. Products: Subject to compliance with requirements, products which may be incorporated in the Work include the following:

    a. VB-250 and VB-350, Barrier-Bac, Inc. 877-535-0555 www.barrierbac.com
    b. 10 mils or 15 mils thick Vapor Block or 16 mils Dura Skrim D16WB, Raven Industries Inc. 605-336-2750 www.ravenind.com
    c. 10 mils or 15 mils thick Stego Wrap, Stego Industries, LLC 281-367-0040 www.stegoindustries.com
    d. 10 mils or 15 mils thick Perminator, by W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com
    e. Polyethylene sheet not less than 10 mils thick (must provide proof of compliance with ASTM E 1745).

F. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

    a. Saniseal, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
    b. Lapidolith, BASF Construction Chemicals – Building Systems (Sonneborn) 800-433-9517 www.buildingsystems.basf.com
    c. Surfhard, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
    d. Burk-O-Lith, Meadow Burke 877-518-7665 www.meadowburke.com
    e. Liqui-Hard, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

G. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

H. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

I. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I-D, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.
2. Do not use curing compound on recessed slab areas which receive paver tile, quarry tile, ceramic tile or terrazzo finish floor material. These areas shall be water cured only.
3. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. A-H 3 Way Sealer, Anti-Hydro International, Inc. 800-777-1773 www.anti-hydro.com
b. Masterkure, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
c. Kure-N-Seal, BASF Construction Chemicals – Building Systems (Sonneborn) 800-433-9517 www.buildingsystems.basf.com
d. Sealco 309, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
e. Conspec #1, Dayton Superior 888-977-9600 www.daytonsuperior.com
f. Day-Chem Cure and Seal, Dayton Superior 888-977-9600 www.daytonsuperior.com
g. Eucocure, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
h. L&M Cure R, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
i. Spartan-Cote, Meadow Burke 877-518-7665 www.meadowburke.com
j. Seal N Kure, Metalcrete Industries 800-526-5602 www.metalcrete.com
k. Stontop CS2, Stonhard 800-257-7953 www.stonhard.com
l. Horn Clear Seal, Tamms 800-862-2667 www.tamms.com
m. CS-309, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

J. Water-Based Acrylic Membrane Curing Compound (SEALER): ASTM C 309, Type I, Class B.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Masterkure, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
b. Sealco – VOC, Cormix International Ltd. +66 2 917 3955-8 www.cormix.com
c. Highseal, Dayton Superior 888-977-9600 www.daytonsuperior.com
d. Safe Cure and Seal, Dayton Superior 888-977-9600 www.daytonsuperior.com
e. Aqua-Cure, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
f. Dress & Seal WB, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
g. Metcure, Metalcrete Industries 800-562-5602 www.metalcrete.com
h. Stontop CS1, Stonhard 800-257-7953 www.stonhard.com
i. Vocomp-20, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

K. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Confilm, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
b. Aquafilm, Dayton Superior 888-977-9600 www.daytonsuperior.com
c. Eucobar, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
d. E-Con, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
e. Waterhold, Metalcrete Industries 800-562-5602 www.metalcrete.com
f. Evapre, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

L. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Polyvinyl Acetate (Interior Only):

1.) Ready Bond, Dayton Superior 888-977-9600 www.daytonsuperior.com
2.) Superior Concrete Bonder, Dayton Superior 888-977-9600 www.daytonsuperior.com
3.) Euco Weld, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
4.) Weld-Crete, Larsen Products Corp. 800-633-6668 www.larsenproducts.com
5.) Everweld, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
6.) Herculox, Metalcrete Industries 800-562-5602 www.metalcrete.com
7.) Intralok, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

b. Acrylic or Styrene Butadiene:

1.) Acryl-Set, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
2.) Sonocrete, BASF Construction Chemicals – Building Systems (Sonneborn) 800-433-9517 www.buildingsystems.basf.com
3.) Day-Chem Ad Bond, Dayton Superior 888-977-9600 www.daytonsuperior.com
4.) Strong Bond, Dayton Superior 888-977-9600 www.daytonsuperior.com
5.) SBR Latex, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
6.) Daraweld C, Grace Construction Products, W.R. Grace & Co. 866-333-3726 www.graceconstruction.com
7.) Everbond, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
8.) Acrylic Bondcrete, Meadow Burke 877-518-7665 www.meadowburke.com
9.) Acrylpave, Metalcrete Industries 800-562-5602 www.metalcrete.com
10.) Stonlock LB2, Stonhard 800-257-7953 www.stonhard.com
11.) Hornweld, Tamms 800-862-2667 www.tamms.com
12.) Acry-Lok, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

M. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Concresive Standard Liquid, BASF Construction Chemicals – Building Systems 800-433-9517 www.buildingsystems.basf.com
b. R-600 Series, Dayton Superior 888-977-9600 www.daytonsuperior.com
c. Resi-Bond (J-58), Dayton Superior 888-977-9600 www.daytonsuperior.com
d. Spec-Bond 100, Dayton Superior 888-977-9600 www.daytonsuperior.com
e. Euco Epoxy System #452 or #620, Euclid Chemical Company 800-321-7628 www.euclidchemical.com
f. Epabond, L&M Construction Chemicals, Inc. 800-362-3331 www.lmcc.com
g. Burke Epoxy M.V., Meadow Burke 877-518-7665 www.meadowburke.com
h. Metco Hi-Mod Epoxy, Metalcrete Industries 800-562-5602 www.metalcrete.com
i. Sikadur 32 Hi-Mod, Sika Corporation, USA 800-933-7452 www.sikaconstruction.com
j. Stonset LV5, Stonhard 800-257-7953 www.stonhard.com
k. Epoxtite Binder 2390, Tamms 800-862-2667 www.tamms.com
l. Rezi-Weld 1000, W.R. Meadows, Inc. 817-834-1969 www.wrmeadows.com

2.4 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

B. The testing laboratory shall perform an aggregate analysis for each type of aggregate used. The aggregate analysis shall be performed on current stockpiles, and shall include sieve analysis, specific gravities, and the dry rodded unit weight of absorption on coarse aggregates. Sieve analysis for coarse aggregate shall include all sieve sizes for each class of coarse aggregate. An additional test shall be performed for every 300 yards of concrete placed, and a new aggregate analysis shall be performed whenever a new source of material is used.

C. Submit written reports to Architect/Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect/Engineer.

D. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 4,000-psi, 28-day compressive strength

    a. 6.0 sacks of cement per cu. yard of concrete (minimum)

2. 3,000-psi, 28-day compressive strength

    a. 5.5 sacks of cement per cu. yard of concrete (minimum)

3. Cement content may be reduced by 1/2 sack per cu. yd. when an approved water reducing admixture or high range water reducing admixture, conforming to the requirements of this specification, is used. This water reducing admixture shall be used in accordance with the manufacturer's recommendations, provided that mix tests yield concrete of not less than the specified strength, and such reduction of cement is accepted in writing by the Architect/Engineer.

E. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. All concrete: W/C 0.50.
2. Subjected to freezing and thawing: W/C 0.50.
3. Subjected to deicers/watertight: W/C 0.40.
4. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps and sloping surfaces: Not more than 3 inches.
2. Reinforced foundation systems: Not less than 1 inch and not more than 5 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 to 3 inch slump concrete.
4. Drilled Piers: Not less than 5 inch and not more than 6 1/2 inches.
5. Other concrete: Not less than 1 nor more than 5 inches.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect/Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect/Engineer before using in Work.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20% max.
2. Ground Granulated Blast-Furnace Slag: 25 percent.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. All concrete: 3 percent to 5 percent.
2. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2-inch maximum aggregate.
b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1-inch maximum aggregate.
c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.
d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2-inch maximum aggregate.

3. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. General: Concrete may be mixed at batch plants or it may be transit-mixed as specified herein. Batch plants must comply with the requirements of ACI 304, with sufficient capacity to produce concrete of the quality specified, in quantities required to meet the construction schedule. All plant facilities are subject to the acceptance of the Architect/Engineer. Plant facilities shall be calibrated by testing agencies specifically qualified for this as frequently as necessary to insure accuracy to plus or minus 0.4% of the total capacity of the components of the plant, but at a frequency not to exceed 6 months.

B. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd. Do not exceed the catalog rating or nameplate capacity for a total volume of materials used per batch. Equip the mixer with automatic controls, or semi-automatic controls, if acceptable, for proportioning materials and the proper measured quantities. Do not exceed 30 minutes total elapsed time between intermingling of damp aggregates and cement to the discharge of the completed mix.

1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

C. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified, provided the quantity and rate of delivery will permit unrestricted progress of the work in accordance with the placement schedule. Discharge of the concrete shall be completed within l-l/2 hours after water is added to the mix or by the time the drum has revolved 300 times, whichever occurs first.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.8 FABRICATION OF REINFORCEMENT

A. General: Shop-fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Identification: Deliver all reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

C. Rejected Materials: Reinforcing with any of the following defects will not be permitted in the work:

1. Bar lengths, depths, and bends exceeding the specified fabrication tolerances. Bends or kinks not indicated on drawings or final shop drawings.
2. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 CUTTING AND PATCHING OF EXISTING SLABS

A. Determine location of grade beams, footings, underground utilities and other below-slab installations prior to cutting of existing slab. Determine most efficient route for new utility installations that will avoid underground conflicts.

B. Neatly cut full depth of existing slab using concrete saws with diamond tipped blades. Avoid cutting through existing wiring, piping, or foundations.

C. Thoroughly clean exposed edges of cut slab and allow to dry.

D. Drill holes in edges of cut slab for snug installation of minimum 5/8” diameter steel bars at maximum 12” centers. Holes shall be drilled minimum 4” deep.

E. Coat ends of bars in 2-part epoxy adhesive and drive tight fully into pre-drilled holes and with a minimum of 12” projecting into new slab area. Wire tie projecting bars to new reinforcing grid.

F. Place vapor retarder on undisturbed subgrade and work perimeter under edges of existing slab a minimum of 2” all around. Lap any required membrane seams 6” and tape.

G. Place reinforcing grid on specified support chairs and wire-tie bars projecting from concrete edges to new reinforcing grid.

H. Coat exposed edges of existing concrete with specified bonding agent just prior to placing new concrete.

I. Place, cure, and finish new concrete as specified below. Finish of new concrete to match adjacent.

3.3 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Anchor bolts shall be set with securely fastened templates, and the threaded area shall be protected from concrete laitance.

C. Hole Forms for Slabs: Install “hole forms” in concrete structures where railing posts are indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.4 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Notify the Architect/Engineer and Testing Laboratory 24 hours before placing concrete.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

1. Do not use concrete which becomes non-plastic and unworkable, or does not meet the requirements quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location.
2. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

C. Concrete Conveying: Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.

1. Provide mechanical equipment of such size and design for conveying concrete to insure a continuous flow of concrete at the delivery end. Provide run-ways above top of finished slab in all places for wheeled concrete conveying equipment for the concrete delivery point to the locations of final deposit. Do not wheel concrete directly over steel reinforcement. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

D. Pumping Concrete: The Contractor may at his option use pumping machines for placing the concrete subject to the following requirements:

1. If for pumping requirements the mix design is other than specified, the Contractor shall furnish to the Architect/Engineer a mix for approval not less than 15 days prior to the time required for its use. The laboratory will make and test this mix design. After the results of these tests are noted and approval is received, this mix can be used. Cost of this laboratory work shall be paid by the Contractor.
2. Whenever concrete is placed by pumping, it is recommended a second pump complete with sufficient pipes and hose for a complete and independent set up, or other placement equipment, be at the job prior to any placing of concrete. The Contractor shall be responsible for any corrective work which results from equipment breakdown.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Bonding: Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent. Clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate, or damaged concrete at the surface.

3.5 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.6 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

B. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

1. Provide moisture curing by the following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Use continuous water-fog spray.
   c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:
   a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
   a. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions, followed by shading or moist curing adequate to keep temperature of the concrete at 80 degrees F or below during the curing period. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
   b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

C. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations. Concrete trucks, cranes, or excessive concentrations of loads will not be permitted on any slab without prior written approval of the Architect/Engineer during the curing period or subsequent construction.

D. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.7 CONCRETE EVALUATIONS:

A. Evaluation of Quality Control Tests: The concrete quality control testing as herein before specified will be evaluated by the following criteria:

1. Do not use concrete delivered to the final point of placement which has a slump or total air content outside the values specified.
2. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to additional testing as herein specified.

3.8 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: An independent testing agency shall perform tests and to submit test reports.

1. The testing laboratory shall monitor concrete properties at time of placement and report to the Contractor any deviation from the project specifications. It shall be the responsibility of the Contractor to control the concrete and comply with the project specifications. If the Contractor cannot adequately control the quality of the concrete, then the Architect/Engineer shall direct the testing laboratory to control the concrete. The cost of this service shall be paid for by the Contractor.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect/Engineer.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of discharge for each concrete load, and for each set of compression test specimens.
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each set of compression tests specimens.
3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
4. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
5. Compressive-Strength Tests: ASTM C 39; for each class of concrete poured in any one day, one set for each day’s pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

D. When the concrete test cylinders are representing suspended structural members, at the contractor's option, two additional cylinders shall be made for the purposes of determining concrete strength for form removal in accordance with the provisions outlined in this section.

E. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

F. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

G. Curing of Compression Test Specimens: After preparation of the test cylinders, to prevent evaporation of water from the unhardened concrete, cover the cylinders immediately after finishing with a non-reactive plate or impervious plastic sheeting. Protect the outside surface of cardboard molds from any source of water for the first 24 hours after casting. Field curing procedures for test cylinders for 28 day compressive strengths are not the same as those for determining strength for form removal time.

1. For test cylinders for 28 days compressive strength determination, during the first 24 hours after molding, store all test cylinders under conditions that maintain the temperature immediately adjacent to the cylinders in the range of 60 to 80 degrees F. and prevent loss of moisture from the specimens. If the Architect/Engineer or testing laboratory have questions concerning the storage temperature, they may require that the contractor provide a temperature record of the

cylinders by means of maximum-minimum thermometers. At the end of 20 hours plus or minus four hours, cylinders are to be transported to the laboratory, removed from the molds, and placed in a moist condition at 73.4 plus or minus 3 degrees F. until the moment of testing.

2. Cure test cylinders to be used for determining strength for form removal time as nearly as practical in the same manner as the concrete in the structure. Cylinders shall be stored in or on the structure as near the point of use as possible, and as far as is practical, with the same exposure to the elements. Remove test cylinders from field storage and store in lime water at 73.4 plus or minus 3 degrees F. for 24 hours plus or minus 4 hours immediately before testing.
3. Cylinders shipped from the field to the laboratory shall be packed in sturdy wood boxes or other suitable containers surrounded by wet sawdust or other suitable packing material and shall be protected from freezing during shipment.

H. Concrete Batch Facility: The testing laboratory shall perform inspections of the concrete batching facility at intervals not to exceed one per 1,000 cubic yards of concrete placed or at least one each six months. The inspection shall include verification of the calibration of scales, aggregate analysis of the current stockpiles, verification of batching procedures, and compliance with the original mix design. First inspection shall take place before any concrete is placed. The cost of each inspection shall be paid by the testing allowance.

1. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests. If any breaks are below specified or expected strengths, the Testing Laboratory shall report any visible anomalies.

I. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

J. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 04 05 03 - MASONRY MORTARING AND GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 01 40 00 – Quality Requirements: Materials Testing.
2. Section 04 20 00 - Unit Masonry Assemblies.
3. Section 04 29 00 – Engineered Unit Masonry.
4. Section 08 11 13 - Standard Steel Frames: Grouting steel door frames.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C150 - Standard Specification for Portland Cement.
3. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
6. ASTM C476 - Standard Specification for Grout for Masonry.
7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
8. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
9. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
10. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Samples: Submit two samples of each type of colored mortar, illustrating mortar color and range; including white color mortar to match existing structural glazed tile joints.

C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:
1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.
2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476.
3. Include descriptions of types and proportions of mortar and grout ingredients.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Preconstruction Testing Services: Provide Material Certificates in lieu of testing, unless otherwise directed by Architect. If Material Certificates are unavailable, notify the Architect immediately upon discovery. Engage a qualified independent testing agency to perform preconstruction testing indicated below if directed by the Architect. Payment for these services will be made by the Owner except in the case of retesting for substandard materials and in the case of first time testing for substandard materials where Material Certificates were submitted as part of the Quality Control procedures for the job. Where considered appropriate by the Architect/Engineer, Prism Test shall be used where completed masonry assemblies are built with potentially substandard materials. Testing of built assemblies determined to contain substandard materials, shall be at the Contractor's expense.

D. Material Certificates (non-load bearing walls): Material Certificates proving compliance with the test below (except the Prism Test) are usually available from manufacturers. Certificates indicating compliance are acceptable to satisfy Quality Control requirements for the individual materials listed when used in masonry assemblies. Use this method of Quality Control in lieu of Prism Test unless total cost of Certificate acquisition is greater than the Prism Tests.
   1. Mortar Test (Property Specification): For each mix required, per ASTM C780.
   2. Grout Test (Compressive Strength): For each mix required, per ASTM C1019 with minimum compressive strength of 2,500 psi.
   3. Prism Tests (required for load bearing walls, conditionally allowed for non-load bearing walls): At the Contractors option, with agreement of the Architect/Engineer, Prism Tests may be used to confirm non-load bearing masonry assembly compressive strength in lieu of Material Certificates.
      a. Prism Test: For each type of reinforced wall construction indicated, per ASTM C1314.
      b. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
      d. Fabricate concrete masonry prisms with height-to-thickness ratio of not less than 1.33 nor more than 3.0.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Portland Cement: ASTM C150, Type I, gray or white color as required to produce mortar color indicated.

B. MASONRY CEMENT SHALL NOT BE USED.

C. Mortar Aggregate: ASTM C144, standard masonry type.

D. Hydrated Lime: ASTM C206, Type S.

E. Grout Aggregate: ASTM C404, fine and coarse.

F. Water: Clean and potable.

G. Mortar Color: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
   1. Manufacturers:

a. "SGS Mortar Colors"; Solomon Grind-Chem Service, Inc., www.solomoncolors.com
b. "True Tone Mortar Colors"; Davis Colors, A Subsidiary of Rockwood Industries, Inc., www.daviscolors.com

H. Water Repellent Admixture: Liquid water repellent mortar admixture intended for use with exterior decorative concrete masonry units containing integral water repellent.
1. Manufacturers:
a. Mortar Tite; Addiment Inc., www.addiment.com
b. Dry-Block Mortar Admixture; W. R. Grace & Co., www.grace.com
c. Rheopel; Master Builders., www.masterbuilders.com
d. RainBloc for Mortar; ACM Chemistries, Inc., www.acmchem.com

I. Calcium chloride is not permitted.

J. AIR ENTRAINING ADMIXTURES SHALL NOT BE USED.

K. ANTIFREEZING ADMIXTURES SHALL NOT BE USED.

2.2 MIXES

A. Mortar Mixes:
1. Mortar for Reinforced CMU Walls: ASTM C270, Type S using Proportion specification.
2. Mortar for Face Brick and Unreinforced CMU Walls: ASTM C270, Type N using Proportion specification.

B. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before mixing process.
3. Add mortar color to achieve uniformity of mix and coloration. Limit mineral-oxide pigments to no more than 10 percent of cement content by weight.
4. Re-temper only within two hours of mixing.

C. Grout Mixes:
1. Grout for Load Bearing and Non-Load Bearing Masonry: Strength as indicated on Drawings; mixed in accordance with ASTM C476.
2. Application:
a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
b. Fine Grout: For grouting other spaces.

D. Grout Mixing:
1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

A. Install mortar in accordance with Section 04 20 00.

B. Low-Lift Grouting:
1. Use Low-Lift grouting technique for all walls and bond beams.
2. Provide minimum clear dimension of 2 inches and clear area of 8 sq. in. in vertical cores to be grouted.

3. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
4. Place horizontal beam reinforced as the masonry units are laid.
5. Lay CMU to maximum pour height. Do not exceed 5 foot height, or if bond beam occurs below 5 foot height stop pour at course below bond beam.
6. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2 inches below top course of pour.
7. Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcing in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Testing Frequency:
1. One set of prism tests for every 5,000 S.F. of completed wall area.
2. One set of mortar tests in accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength, for every 25 C.Y. mortar.
3. One set of grout tests in accordance with ASTM C780 for compressive strength and slump, for every 25 C.Y. grout.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Face brick with weeps and inserts.
2. Concrete masonry units.
3. Decorative concrete masonry units.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Related Sections:
1. Section 03 20 00 – Concrete Reinforcement.
2. Section 04 05 03 - Masonry Mortaring and Grouting: Mortar and grout.
3. Section 04 29 00 – Engineered Unit Masonry.
4. Section 05 12 00 - Structural Steel Framing: Product requirements for steel anchors for placement by this section.
5. Section 05 50 00 - Metal Fabrications: Product requirements for loose steel lintels for placement by this section.
6. Section 07 27 26 – Fluid-Applied Membrane Air Barrier.
7. Section 07 90 00 - Joint Protection: Rod and sealant at control and expansion joints.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
4. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
5. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
6. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
7. ASTM C1364 - Standard Specification for Architectural Cast Stone.
8. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
9. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data:

1. Submit data for decorative masonry units, fabricated wire reinforcement, wall ties, anchors, cavity drainage material, and other accessories.
2. Submit data for cleaning solutions, including detailed description of methods, materials, equipment and site cleanup procedures to be used. Provide with letters of approval from brick and cleaning material manufacturers regarding the compatibility of proposed use of products together for cleaning purposes.

C. Samples:
1. Submit four samples of each type of decorative masonry unit and face brick, to illustrate color, texture and full color range. Furnish additional samples when necessary to fully illustrate the complete range of highly variable materials.
2. Submit color samples for glazed units.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Shop Drawings:
1. Submit shop drawings for fabrication, bending, and placement of reinforcement bars and for steel templates for layout of dowels for masonry columns and pilasters. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
2. Provide dimensioned plan and details indicating layout, sizes, and shapes, and vertical heights of all structural glazed tile walls.
3. Submit detailed shop drawings for custom sized/shaped units including shaped brick and cast stone.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

B. Fire Rated Wall Construction: Rating as indicated on Drawings.
1. Tested Rating: Determined in accordance with ASTM E119.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mockup requirements.

B. Construct cavity masonry wall mockup, 8 feet long by 8 feet high, including masonry, mortar and accessories, structural backup, flashings, wall insulation, and weeps.
1. Structural backup wall to be same as building designed backup, whether CMU, steel studs, or other. Verify with Architect where building design utilizes more than one type of backup.
2. Include a sealant-filled control joint.
3. Omit masonry above flashing to leave a 12 inch length of the flashing exposed to view.
4. Clean face of mockup with masonry cleaner using methods anticipated for the Work.

C. Furnish removable cover to protect completed mock-up from rain or other environmental or site conditions that may alter its appearance.

D. Locate where directed by Architect/Engineer. Keep top of mock up wall covered with weighted waterproof tarp.

E. Remove mockup when directed by Architect/Engineer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept masonry units and accessories on site. Inspect for damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

D. Bracing of Work in Progress:
1. Where masonry erection may be exposed to high winds, installation shall be adequately braced until masonry construction has attained sufficient strength to resist wind forces.
2. Shores and forms shall not be removed until masonry construction has attained sufficient strength to support its own weight and all other construction or environmental loads.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with work of other trades built into or adjoining masonry work.

PART 2 PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: ASTM C652, Grade SW, Type HBS, HBX, or HBA in accordance with the particular units selected for use, as indicated on Drawings.
1. Sizes and Manufacturers:
a. Modular: As required to match existing material in size, color, and finish.
b. King Size: As required to match existing material in size, color, and finish.
2. Furnish special shaped units where indicated on Drawings, and for corners other than 90 degrees, window sills, outside corners of soldier courses, and other locations to ensure against exposed cores or unfinished faces or ends.

B. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, lightweight.
1. Size: Nominal modular size of 16 inches long x 8 inches high x thickness indicated.
2. Furnish special units for bond beams and lintels as noted on structural drawings.
3. Furnish bullnose corners at units exposed to interior of building.

C. Decorative Concrete Masonry Units: ASTM C90
1. Ground-Faced with decorative aggregate as manufactured by Headwaters or approved equivalent in color and finish by *Best* or *Boral.*
2. Sizes: Nominal modular size of 16-inches long x 8-inches high x indicated thicknesses.

3. Integral Water Repellent: Units installed exposed to the exterior shall be fabricated with integral liquid polymeric water-repellent admixture. Admixture shall not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
   a. Manufacturers:
      (1) Dry-Block; W. R. Grace & Co., Construction Products Division, www.grace.com
      (2) Rheopel; BASF www.basf-admixtures.com
      (3) RainBloc; ACM Chemistries, Inc., www.acmchem.com

D. Mortar and Grout: As specified in Section 04 05 03 and as noted on Structural Drawings.

2.2 ANCHORS, TIES AND REINFORCEMENT

A. Manufacturers:
   1. AA Wire Products
   2. Heckman Building Products, www.heckmannbuildingprods.com
   3. Hohmann & Barnard (Dur-O-Wall), www.h-b.com
   4. Masonry Reinforcing Corp. of America (Wire-Bond)
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Single Wythe Joint Reinforcement: ASTM A951; ladder type; steel; 9 gage side rods and cross ties; hot dip galvanized

C. Strap Anchors: Bent steel, 1-1/2 inches wide x 24 inches long x 1/4 inch thick, with ends turned up not less than 2 inches; ASTM A153/A153M hot dip galvanized.

D. Veneer Ties for CFMF Stud Backup Walls: Rib-stiffened sheet metal plate anchors with screw holes top and bottom and projecting tabs with slotted holes for receiving vertical legs of adjustable wire ties; ASTM A153/A153M hot dip galvanized.
   1. Anchor Size: 2-3/4 inches wide by 3 inches high.
   2. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
   3. Tie Shape: Rectangular
   4. Fasteners: Type 304 stainless steel hex-washer head screws with carbon drill point as provided by Hohmann & Barnard.
      a. Size: #12 diameter x length required to penetrate steel stud flange by not less than 3 exposed threads.
      b. Complete with stainless steel backed neoprene sealing washer.
   5. Basis of Design:
      a. Running Bond Brick: **Hohmann & Barnard HB-200X**.
      b. Stacked Bond or Soldier Course Brick: **Hohmann & Barnard HB-213 SH or 300C/HB-213 Seismic.** Provide with hot-dip galvanized 0.1875 inch diameter wire reinforcing continuous within horizontal brick joint.

E. Veneer Ties for CMU Backup Walls: ASTM A82; ladder type joint reinforcement with adjustable eye and pintle type wire ties; ASTM A153/A153M hot dip galvanized.
   1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
   2. Tie Shape: Rectangular
   3. Fasteners: #12 stainless steel screws self-tapping screws.
   4. Basis of Design:
      a. Modular Brick: Hohmann & Barnard, **#270 Ladder Eye-Wire**.
      b. King Size Brick: **Hohmann & Barnard, 2-Seal™ Concrete Seal Tie,** wire tie with hot-dip galvanized 0.1875 inch diameter wire reinforcing continuous within horizontal brick joint**.**

F. Veneer Ties for Grade Beams and Concrete Backup Walls: Zinc-alloy barrel section with flanged head and eye, fastened with corrosion-resistant, self-drilling screw. Eye designed to receive tie and to serve as head for drilling fastener into concrete. Provide barrel length to suit cavity wall insulation thickness, allowing screw to seat directly against the concrete wall with flanged head covering hole in insulation.
   1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
   2. Tie Shape: Triangular.
   3. Basis of Design: **Hohmann & Barnard, 2-Seal™ Concrete Seal Tie**.

G. Dovetail Anchors: Bent steel strap formed from 0.1046 inch thick steel, with 0.1875 inch diameter triangular-shaped wire tie sized to extend within 1 inch of masonry face; ASTM A153/A153M hot dip galvanized.

H. Steel Beam and Column Anchors: Crimped 1/4 inch diameter wire anchor welded to steel member, with 0.1875 inch diameter triangular-shaped wire tie for solid masonry and rectangular-shaped wire tie for hollow masonry, sized to extend within 1 inch of masonry face; ASTM A153/A153M hot dip galvanized.

I. Reinforcing Steel: Type specified in Section 03 20 00.

J. Anchor Bolts: ASTM A307; Grade A; J-shaped or L-shaped; complete with flat washers and heavy hex nuts; hot-dipped galvanized finish, ASTM A153/A153M.

2.3 EMBEDDED FLASHING MATERIALS

A. Stainless Steel: ASTM A240, Type 304, soft temper; 0.016 inch thick; smooth finish.

B. Asphalt-Coated Copper Flashing: 5 oz/sq ft rolled sheet copper coated with flexible asphalt.
   1. Manufacturers:
      a. Cop-A-Cote; AFCO Products, Inc., www.afcoproducts.com
      b. Type ACC-Asphalt Bituminous Coated; Phoenix Building Products.
      c. Coated Copper Flashing; Sandell Manufacturing Co., Inc., www.sandellmfg.com
      d. Substitutions: Section 01 60 00 - Product Requirements.

C. Rubberized Asphalt Flashing: Composite flashing sheet consisting of self-adhesive rubberized asphalt compound bonded to a high-density cross-laminated polyethylene film; overall thickness of 0.030 inch.
   1. Do not install rubberized asphalt flashing adjacent to or in contact with flexible vinyl or PVC products.
   2. Manufacturers:
      a. Perm-A-Barrier Wall Flashing; W. R. Grace & Co., www.grace.com
      b. Vycor V-40; W. R. Grace & Co., www.grace.com
      c. Polyguard 400; Polyguard Products, Inc., www.polyguardproducts.com
      d. Cloaked Flashing System, Hyload Inc., www.HyloadFlashing.com
      e. Substitutions: Section 01 60 00 - Product Requirements.

D. Lap Sealant: Type specified in Section 07 90 00.

2.4 ACCESSORIES

A. Joint Filler: ASTM D1056, Grade 2A1, closed cell neoprene; oversized 50 percent to joint width; self-expanding.

B. Cavity Wall Insulation: Extruded polystyrene board specified in Section 07 21 13.

C. Cavity Drainage Material: Open polyethylene mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
   1. Manufacturers:
      a. Mortar Break; Advanced Building Products Inc., www.advancedflashing.com

b. Mortar Net; Mortar Net USA, Ltd., www.mortarnet.com
c. CavClear Masonry Mat, Archovations, Inc., www.cavclear.com
d. Substitutions: Section 01 60 00 - Product Requirements.

D. Weeps and Inserts:
1. Open Head Joints: Full head height for face brick, 3 inches high for CMU. Space at 20” or 24” O.C depending on brick size. All weep joints to receive inserts.
2. Weep Inserts: Install stainless steel inserts at each weep. Inserts as manufactured by Weepa, www.weepa.com or approved equivalent by Rid-O-Mice.

E. Cleaning Solutions:
1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.
2. Proprietary Acidic Cleaner: Standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry and pigmented mortar surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
a. Manufacturers:
1) Diedrich Technologies, Inc.
2) EaCo Chem, Inc.
3) ProSoCo, Inc.
4) AHI Supply
5) Substitutions: Section 01 60 00 - Product Requirements.

F. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Lay exposed masonry to match existing bond pattern(s):
1. Coursing of Concrete Masonry Units:
a. Bond: Running or match existing.
b. Coursing: One unit and one mortar joint to equal 8 inches.

c. Mortar Joints: Concave.

2. Typical Coursing of Modular Brick Units:
   a. Bond: 1/2 running.
   b. Coursing: Three units and three mortar joints to equal 8 inches.
   c. Mortar Joints: Concave.
3. Typical Coursing of King Size Brick Units:
   a. Bond: 1/3 running.
   b. Coursing: Three units and three mortar joints to equal 9 inches.
   c. Mortar Joints: Concave.
4. Coursing of Reinforced Concrete Masonry Units:
   a. Bond: Running.
   b. Coursing: One unit and one mortar joint to equal 8 inches.
   c. Mortar Joints: Tooled concave.
5. Coursing of Decorative Concrete Masonry Units:
   a. Bond: Running.
   b. Coursing: One unit and one mortar joint to equal 8 inches.
   c. Mortar Joints: Concave.

D. Placing and Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
   a. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
   b. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with motor-driven saws to assure straight, clean, un-chipped edges. Prevent broken masonry unit corners or edges. Where possible, use full-size units without cutting.
8. Install cut units with cut surfaces and edges concealed.
9. Select and arrange exposed units to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
10. Cut mortar joints flush where wall tile is scheduled or bitumen dampproofing is applied.
11. Cut mortar fins protruding into cavity from back side of face brick as work progresses.
12. Isolate masonry from vertical structural framing members.
13. At full-height walls, leave a 1” space between top of masonry and floor or roof structure above. Brace masonry from structure with 16- gauge galvanized steel angles having 4” equal legs and 8” lengths mechanically anchored to the floor or roof structure and spaced not more than 4’-0” on center.
14. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

E. Weeps and Inserts: Install weeps and inserts in outer wythe at maximum 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and above other obstructions of wall cavity continuity.

F. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and bituminous dampproofing.
1. Install cavity drain material, notched end up, continuously at bottom of each cavity above embedded flashing.

G. Stain Prevention: As work progresses, prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

H. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

3.4 JOINT REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement in CMU walls 16 inches oc.

B. Place joint reinforcement in first and second horizontal joints above and below openings greater than 12 inches wide. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joints below tops of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Cut or interrupt joint reinforcing at control and expansion joints.

F. At corners, install horizontal joint reinforcement with prefabricated “L” intersections.

G. At intersecting and abutting walls, unless vertical expansion or control joints are shown at juncture, install horizontal joint reinforcement with prefabricated “T” intersections.

H. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

I. Install anchors attached to concrete and steel structural members:
   1. Leave an open space not less than 1 inch in width between back of masonry and face of structural member. Keep open space free of mortar or other rigid materials.
   2. Install anchors at maximum 16 inches o.c. vertically and horizontally.

J. Install Wall Ties at CMU Backup Walls:
   1. Install wall ties at 16 inches oc vertically and maximum 16 inches oc horizontally.
   2. Coordinate ties to accommodate installation of 16 inch widths of cavity wall insulation specified in Section 07 21 13.
   3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.

3.5 MASONRY FLASHINGS:

A. Provide concealed flashing in masonry work at or above shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior.

B. Form flashings from the following materials:
   1. Exposed flashings: Stainless steel.

2. Concealed flashings: Asphalt-coated copper or rubberized asphalt, at contractor's option.

C. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar.

D. Extend flashings horizontally through exterior face of masonry and turn down 1/4 inch to form drip.

E. Turn flashing up minimum 8 inches and bed into mortar joint of CMU backup wall or seal to sheathing over CFMF stud backup wall.

F. Lap end joints minimum 6 inches and seal watertight.

G. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end; turn up ends not less than 2" to form end dams as recommended by BIA and illustrated in BIA Technical Note 7, Figure 21, current edition.

H. Turn flashing, fold, and seal at corners, bends, and interruptions.

I. Lintels:
1. Install loose steel lintels over openings more than 12 inches wide in brick walls.
2. Install reinforced unit masonry lintels over openings more than 24 inches wide in CMU walls.
   a. Reinforce lintels as indicated on Drawings.
   b. Do not splice reinforcing bars.
   c. Support and secure reinforcing bars from displacement.
   d. Place and consolidate grout fill without displacing reinforcing.
   e. Allow masonry lintels to attain specified strength before removing temporary supports.
3. Maintain minimum 8 inch bearing on each side of opening.

J. Grouted Components:
1. Reinforce bond beams and pilasters as indicated on Drawings.
2. Splice reinforcement in accordance with Section 03 20 00.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.
6. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

K. Reinforced Masonry:
1. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcement bars as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03 20 00.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

L. Control And Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Interior Partitions: 25'-0" o.c. horizontally.
   b. Exterior Cavity Walls: 20'-0" o.c. horizontally.
   c. Steel Lintels: Provide horizontal bond breaks as detailed on Drawings at the end bearing to allow for thermal expansion and contraction.
   d. Openings in Exterior and Interior Walls: At masonry with steel lintels, provide

expansion joints on each side of the opening continuing to the top and bottom of the brick wythe and as specified above. At CMU lintels, provide control joints in alignment with the outside ends of the lintel continuing to the bed joint and then with horizontal bond breaks at the end bearing.

e. Veneer Construction: Provide horizontal pressure relieving joints beneath shelf angles as recommended by BIA Technical Note 28B current edition.

f. At changes in wall height.

2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Form expansion joint by omitting mortar and cutting unit to form open joint.

M. Built-In Work:
1. As work progresses, install built-in door and window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and window frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
5. Do not build in materials subject to deterioration.

N. Cutting and Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items penetrating masonry. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.6 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft; 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
3. Plus or minus 1 inch when distance is between 8 and 24 inches.
4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
5. Plus or minus 2 inches from location along face of wall.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

F. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution, or clean masonry with approved cleaner applied according to the brick and the cleaning manufacturer's written instructions and approval.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.
7. Do not use high-pressure washing methods (greater than 700psi as described in BIA Technical Notes No. 20) on single wythe construction, on concrete masonry incorporating integral or applied water repellents, or on sand-finished face brick.

3.8 DEFECTIVE CONSTRUCTION

A. Correct defects appearing in the finished work for a period of one year after the date of Substantial Completion.

B. Defects shall include, but not be limited to, cracking, separating or color leaching of mortar, cracking, discoloration, or deterioration of masonry units, efflorescence in masonry units or joints, and water penetration through face brick or joints under normal exposure.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.

D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.2 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.

B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

1.3 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2023.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2013 (Reapproved 2018).

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

I. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

J. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

L. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

M. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

O. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

P. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

Q. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

R. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi ield Strength; 2020.

S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

T. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

U. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

W. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

X. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Connections not detailed.

3. Indicate cambers and loads.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) Steel Construction Manual.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Erector: Company specializing in performing the work of this section with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

F. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

G. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

I. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.

J. Headed Anchor Rods: ASTM F1554 Grade 36, plain.

K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

L. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.

2. Minimum Compressive Strength at 28 Days: 5000 pounds per square inch.

3. Height Change, Plastic State; when tested according to ASTM C827/C827M:

   a. Maximum: Plus 4 percent.

   b. Minimum: Plus 1 percent.

M. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.2 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.4 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts, testing at least 10 percent of bolts at each connection.

B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts .

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts, testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 12 00

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SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.

B. Section 05 12 00 - Structural Steel Framing: Superstructure framing.

C. Section 05 31 00 - Steel Decking: Bearing plates and angles.

D. Section 05 31 00 - Steel Decking: Support framing for openings less than 18 inches in decking.

E. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

F. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

G. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

H. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

I. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

J. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

P. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

Q. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

S. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Fabricator's Qualification Statement.

E. Erector's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

1. Maintain one copy of document on site.

C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

F. Erector Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.6 DELIVERY STORAGE AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws
2. New Millennium Building Systems: www.newmill.com/#sle.
3. Nucor-Vulcraft Group: www.vulcraft.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
4. Finish: Shop primed.

B. Open Web Joists: SJI 100 Type DLH Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
4. Finish: Shop primed.

C. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

D. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

F. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Drill holes in chords for attachment of wood nailers where indicated.

B. Space stud shear connectors on top of top chords at 16 inches on center.

2.4 FINISH

A. Shop prime joists as specified.

1. Do not prime surfaces that will be fireproofed.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.5 SOURCE QUALITY CONTROL

A. Provide shop testing of steel components as follows:

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts , testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches.

F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

H. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts , testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 21 00

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SECTION 05 31 00 - STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof deck.

B. Composite floor deck.

C. Supplementary framing for openings up to and including 18 inches.

D. Bearing plates and angles.

E. Stud shear connectors.

F. Acoustical insulation in roof deck flutes.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal deck.

B. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.

C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

D. Section 05 21 00 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.

E. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.

F. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

J. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; 2022.

K. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements; 2019, with Editorial Revision (2021).

L. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Cellular Floor Deck Electrical Raceway System: Coordinate the work with other trades to provide electrical service fittings compatible with the raceway system to be installed.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Submit manufacturer's installation instructions.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.6 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years of experience.

1.7 DELIVERY STORAGE AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Deck:

1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. Cordeck, Inc: www.cordeck.com.
3. New Millennium Building Systems: www.newmill.com/#sle.
4. Nucor-Vulcraft Group: www.vulcraft.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.

1. Calculate to structural working stress design and structural properties specified.
2. Maximum Vertical Deflection of Floor Deck: 1/360 of span.
3. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
4. Maximum Vertical Deflection of Form Deck: 1/360 of span.
5. Maximum Lateral Deflection of Diaphragms: 1/500 of the height of the wall.

B. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Structural Properties:
    a. Span Design: Multiple.
3. Minimum Base Metal Thickness: See Drawings.
4. Nominal Height: 1-1/2 inch.
5. Profile: Fluted; SDI B.
6. Formed Sheet Width: 36 inch.
7. Side Joints: Lapped, mechanically fastened.
8. End Joints: Lapped, See Drawings.

C. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Span Design: Double.
3. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch.
4. Nominal Height: 1-1/2 inches.
5. Profile: Fluted; SDI WR.
6. Formed Sheet Width: 36 inch.
7. Side Joints: Lapped, mechanically fastened.
8. End Joints: Lapped, welded.

2.3 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

B. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.

C. Welding Materials: AWS D1.1/D1.1M.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
2. Material: Steel; ASTM A510/A510M.
    a. Hardness: Rockwell C 54.5, minimum.
    b. Tensile Strength: 285 kips per square inch, minimum.
    c. Shear Strength: 175 kips per square inch, minimum.
    d. Washers:
        1) Steel Bar Joist Framing Applications: 0.472 inch diameter, minimum.
    e. Corrosion Resistance:

F. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.

2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.

3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

4. Products:

   a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

   b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

I. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.4 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

C. Floor Drain Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods indicated on drawings.

1. Welding: Use fusion welds through weld washers.

E. At mechanically fastened male/female side laps fasten at 12 inches on center maximum.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. At welded male/female side laps weld at 18 inches on center maximum.

H. Weld deck in accordance with AWS D1.3/D1.3M.

I. At deck openings from 6 inches to 18 inches in size, provide 2 by 2 by 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

J. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as specified in Section 05 12 00.

K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

L. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

M. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

N. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

O. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

P. Weld stud shear connectors through steel deck to structural members below.

Q. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Exterior wall sheathing.

C. Formed steel joist and purlin framing and bridging.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.

B. Section 07 92 00 - Joint Sealants.

1.3 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.4 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

E. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout.

2. Describe method for securing studs to tracks and for screw framing connections.

F. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

G. Installation Drawings: Indicate dimensioned locations of cold-formed steel structural framing.

1. Include materials, corrosion protection, base steel thickness, and dimensions.

1.7 QUALITY ASSURANCE

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.8 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.

C. Mock-Up Size: As indicated on drawings.

D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Structural Framing:

1. CEMCO: www.cemcosteel.com.
2. ClarkDietrich: www.clarkdietrich.com.
3. Jaimes Industries: www.jaimesind.com.
4. MarinoWARE: www.marinoware.com/#sle.
5. SCAFCO Corporation: www.scafco.com.
6. Steel Construction Systems: www.steelconsystems.com.
7. Telling Industries: www.tellingindustries.com/#sle.
8. The Steel Network, Inc: www.SteelNetwork.com.
9. Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:

1. Same manufacturer as metal framing.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with requirements for Contractor's design-related professional design services indicated in Section 01 40 00 - Quality Requirements.

2.3 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.4 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet design criteria.
2. Provide components fabricated from ASTM A1011/A1011M Designation SS (structural steel).
3. Products:
    a. MarinoWARE; StudRite: www.marinoware.com/#sle.
    b. MarinoWARE; Structural Framing: www.marinoware.com/#sle.
    c. MBA Building Supplies; Structural Studs & Track: www.mbastuds.com/#sle.
    d. Super Stud Building Products, Inc; SuperMAXX Studs: www.buysuperstud.com/#sle.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Jamb Studs: AISI S240; manufactured, engineered, c-shaped with wide flanges, designed to replace conventional double-stud framing at openings.
1. Thickness: 33 mils, 0.0329 inch.
2. Products:
    a. SCAFCO Corporation; Kwik-Jamb Studs: www.scafco.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Headers: AISI S240; manufactured, engineered one-member or two-member assemblies, with wide flanges, designed to replace conventional box or nested header framing at openings.
1. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
2. Thickness: 33 mils, 0.0329 inch.
3. Jamb Mounting Clips: Manufacturer's standard.
4. Cripple Stud Clips: Manufacturer's standard.
5. Products:
    a. CEMCO; ProX Header: www.cemcosteel.com/#sle.
    b. ClarkDietrich; RedHeader PRO: www.clarkdietrich.com/#sle.
    c. SCAFCO Corporation; HD Header: www.scafco.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Joists: AISI S240; manufactured, engineered open-web steel joists.
1. Thickness and Depth: As indicated on drawings.

2. Products:

a. ClarkDietrich; TradeReady Joist: www.clarkdietrich.com/#sle.

b. MarinoWARE; JoistRite: www.marinoware.com/#sle.

c. Super Stud Building Products, Inc; SuperMAXX Joists: www.buysuperstud.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 LATERAL FORCE-RESISTING SYSTEMS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

B. CONNECTIONS

1. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

2. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

a. Structural Grade: As required to meet design criteria.

b. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

4. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.

a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

c. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 10 feet.

d. Products:

1) ClarkDietrich; Drift FastClip Slide Clip D-FCSC: www.clarkdietrich.com.

2) ClarkDietrich; FastClip Slide Clip FCSC: www.clarkdietrich.com.

3) MarinoWARE; Slotted Track: www.marinoware.com/#sle.

4) MBA Building Supplies; Slotted Track: www.mbastuds.com.

5) Simpson Strong Tie: www.strongtie.com.

6) Super Stud Building Products, Inc; Deflection Clips: www.buysuperstud.com.

7) Substitutions: See Section 01 60 00 - Product Requirements.

5. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

a. Products:

1) Simpson Strong Tie: www.strongtie.com.

2) Substitutions: See Section 01 60 00 - Product Requirements.

6. Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connectors where indicated on the drawings.

7. Products:

a. ClarkDietrich; Spazzer 5400 Bridging Bar: www.clarkdietrich.com/#sle.

b. ClarkDietrich; FastBridge Clip: www.clarkdietrich.com/#sle.

c. Simpson Strong-Tie; SUBH Bridging Connector: www.strongtie.com/#sle.

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

1. Products:

a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Anchorage Devices: Powder actuated.

2.7 SHEATHING

A. Glass-mat-faced gypsum board; ASTM C1177/C1177M, square long edges, 5/8 inch thick, Type X - fire-resistant.

2.8 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

D. Water-Resistive Barrier: ICC-ES AC38 Grade D and 60-minute plastic sheet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.2 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.3 INSTALLATION OF STUDS

A. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

B. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

C. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

D. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

E. Install intermediate studs above and below openings to align with wall stud spacing.

F. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

G. Attach cross studs to studs for attachment of fixtures anchored to walls.

H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

I. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.4 INSTALLATION OF JOISTS

A. Place joists at 16 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

B. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

C. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

D. Provide web stiffeners at reaction points.

E. Touch-up field welds and damaged galvanized surfaces with primer.

3.5 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges, and ends.

3.6 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide material verification inspections in accordance with requirements of AISI S240.

3.7 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items.
   1. Loose lintels.
   2. Bollards.
   3. Steel ladders.
   4. Structural supports for miscellaneous attachments.
   5. Steel framing and supports for mechanical and electrical equipment.
   6. Other miscellaneous steel items indicated or required for complete installation of indicated work.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   2. Section 05 12 00 - Structural Steel Framing.
   3. Section 05 21 00 - Steel Joists Framing.
   4. Section 05 31 00 – Steel Decking.
   5. Section 09 90 00 - Painting and Coating: Field applied paint finish.
   6. Section 14 24 00 – Hydraulic Elevators – Requirements for steel ladder at elevator pit.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   6. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   7. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   8. ASTM F436 - Standard Specification for Hardened Steel Washers.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

C. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 15 - Steel Joist Shop Paint.
   2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALIFICATIONS

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.6 FIELD MEASUREMENTS

A. Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Plate: ASTM A36/A36M.

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40. .

E. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality with galvanized coating.

F. Bolts: ASTM A307; Grade A or B.

G. Nuts: ASTM A563 heavy hex type.

H. Washers: ASTM F436; Type 1.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Shop Primer: SSPC Paint 15, or manufacturer’s standard primer complying with performance requirements of SSPC Paint 15.

K. Touch-Up Primer: Match shop primer.

L. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20.

2.2 LOOSE LINTELS

A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.

B. Galvanize loose lintels installed in exterior walls and provide with shop primer ready for field finish painting.

2.3 ANGLE EXTENSIONS FOR WIRE MASONRY ANCHORS

A. Fabricate angle extension for wire masonry anchors from steel angles, 2" x 2" x 1/8". Provide a 1/4" x 1" slot in the vertical leg of the angle, 1" back from the end for receiving the 3/16" wire masonry anchors specified in Division 4 Section "Unit Masonry". Fabricate in

lengths such that the overall length of the angle extension is equal to the distance from the web of column or beam to 1" from the back of the masonry wall. Reference detail in drawings for additional clarification.

B. Weld the angle extension, with a continuous fillet weld, at 16" o.c. horizontally at beam webs and vertically at column webs where support of masonry walls is indicated.

2.4 BOLLARDS

A. Fabricate bollards from Schedule 80 steel pipe, size as indicated.

B. Standard Bollards: Fill with 3,000 psi concrete as specified in Section 03 30 00, with crowned cap.

C. Removable Bollards: Fabricate sleeves from Schedule 40 steel pipe or 1/4 inch wall thickness steel tubing with an ID 1/4 inch less than OD of bollards. Match drill sleeve and bollard for 1/2-inch steel machine bolt.
1. Cap removable bollards with 1/4 inch minimum steel plate. Do not fill with concrete.

2.5 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
1. Comply with ANSI A14.3, unless otherwise indicated.
2. Provide hot-dip galvanizing after fabrication for exterior ladders.
3. For elevator pit ladders, comply with ASME A17.1.

B. Side Rails: Continuous 1/2 x 2-1/2 inch flat bars with eased edges, spaced 18 inches apart.

C. Bar Rungs: 3/4 inch round steel reinforcing bars, spaced 12 inches o.c. vertically.
1. Fit bar rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
2. Finish:
a. Elevator Pit Ladder: Hot dip galvanized, no paint.
b. Roof Hatch Ladder: Shop primed for field painting.

D. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3. Brackets finished same as ladder.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural steel framework as necessary to complete the Work.

B. Fabricate units from structural steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
2. Furnish inserts if units must be installed after concrete is placed.

C. Operable Partitions: Fabricate supports for operable partitions of continuous steel shapes of sizes indicated, with attached bearing plates, anchors, and braces. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition shop drawings.

2.7 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.8 FACTORY APPLIED FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing: Hot-dip galvanize all items exposed to the exterior, ASTM A123/A123M, minimum 2.0 oz/sq ft coating thickness.
1. Galvanize after fabrication.
2. After galvanizing, fill vent holes and grind smooth
3. Do not apply galvanizing using double- dip or progressive processes without Architect’s or Engineer’s written approval.
4. Galvanizing for Fasteners, Connectors, and Anchors:
a. Hot-Dipped Galvanizing: ASTM A153/A153M.
b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

C. Prime paint items with one coat except where galvanizing is specified.
1. Do not prime surfaces in direct contact with concrete or where field welding is required.

2.9 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 00 – PAINTED STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Painted steel railings at catwalk as indicated in the drawings.

B. Related Sections:
   1. Section 09 90 00 - Painting and Coating: Field-applied finish paint.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 15 - Steel Joist Shop Paint.
   2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

A. Design guardrail and attachments to resist forces as required by applicable code. Apply loads non-simultaneously to produce maximum stresses.
   1. Guard Top Rail Concentrated Load: 200 pounds applied at any point in any direction.
   2. Guard Top Rail Uniform Load: 50 plf applied in any direction.
   3. Intermediate Rails, Panels, and Baluster Concentrated Load: 50 pounds applied to 1 sf area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 STEEL RAILING SYSTEM COMPONENTS

A. Shapes, Plates, and Bars: ASTM A36/A36M.

B. Pipe: ASTM A53/A53M, Grade B, Schedule 40.

C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast steel.

D. Splice Connectors: Steel welding collars.

E. Shop Primer: SSPC Paint 15, Type 1, red oxide.

F. Touch-Up Primer: Match shop primer.

2.2 MISCELLANEOUS COMPONENTS

A. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

B. Cast-in-Place and Post-installed Anchors: Anchors of type indicated below, fabricated from

corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete.
1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

C. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Brackets, Flanges, and Anchors: Cast or formed metal of same material and finish as supported rails, unless otherwise indicated.
1. Manufacturers:
a. Malleable Iron or Cast Steel: Series 378/ 1378; Julius Blum and Co. www.juliusblum.com

2.3 FABRICATION

A. Preassemble handrails and railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members as follows:
1. By flush radius bends.
2. By inserting prefabricated flush-elbow fittings.

C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.

E. Fasteners: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

G. For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, and steel plate forming bottom closure.

H. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

I. Joining Components: Continuously seal joined pieces by continuous welds.

J. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt

tight, flush, and hairline. Ease exposed edges to small uniform radius.

K. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

2.4 FINISHES

A. Shop prime steel railings and hardware not galvanized or prefinished. Do not prime surfaces that will be embedded in concrete or masonry.

B. Shop prime galvanized steel railings and hardware indicated to be painted. Do not prime surfaces that will be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete, embedded in masonry, or placed in partitions with setting templates.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Set embedded posts in pipe sleeves and fill space between post and sleeve with nonshrink grout.

C. Fit exposed connections together to form tight, hairline joints.

D. Anchor railings to structure.

E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

G. Assemble tube rails with sleeves to accommodate tight joints and secure installation.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Blocking in wall and roof openings.
2. Plywood sheathing.
3. Wood furring and grounds.
4. Concealed wood blocking for support of toilet accessories, wall cabinets, handrails, and other wall-mounted items.
5. Telephone and electrical panel back boards.
6. Fire retardant and preservative treatment of wood.

1.2 REFERENCES

A. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

B. American Wood-Preservers' Association:
1. AWPA U1 - User Specification for Treated Wood.

C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Southern Pine Inspection Bureau:
1. SPIB - Standard Grading Rules for Southern Pine Lumber.

E. U.S. Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Construction and Industrial Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

F. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association:
1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Plywood Grading Agency: Certified by EWA - The Engineered Wood Association.
3. Lumber: DOC PS 20.
4. Plywood: DOC PS 1 or DOC PS 2.

B. Surface Burning Characteristics:
1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire-retardant treated material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: AF&PA, SPIB, WCLIB, WWPA G-5.

B. Miscellaneous Framing: Southern pine, mixed southern pine or spruce-pine-fir species; 19 percent maximum moisture content.

C. Plywood: APA/EWA; southern pine or Douglas fir species; 1/2 inch thick, minimum.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished or cadmium plated steel elsewhere.
2. Nails and Staples: ASTM F1667.
3. Anchors:
a. Toggle bolt type for anchorage to hollow masonry.
b. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
c. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Preservative Treatment: AWPA U1, Use Category UC2; using inorganic boron (SBX) preservative with 0.25 percent retainage.

B. Fire Retardant Treatment: AWPA U1, Use Category UCFA for interior use, and UCFB for exterior use; chemically treated and pressure impregnated.

C. Moisture Content after Treatment:
1. Lumber: Maximum 19 percent.
2. Plywood: Maximum 15 percent.

2.4 FIELD WOOD TREATMENT

A. Preservative Treatment: Brush applied inorganic boron solution, with minimum concentration of 1.5 percent.

B. Touch-up cut wood ends.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Construct curb members of solid wood sections.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by

alternating lapping side members.

E. Coordinate curb installation with installation of decking and support of deck openings.

F. Secure sheathing to framing members with ends over firm bearing and staggered.

G. Install plywood parapet sheathing using 1/- inch thick plywood. Space panels 1/8 inch apart at edges and ends.

H. Install telephone and electrical panel back boards using 3/4 inch thick plywood. Size back boards 12 inches beyond size of electrical and telephone panel, or as indicated on Drawings.

3.4 SCHEDULE OF WOOD TREATMENT

A. Note: The term “Treated” as may be used on the drawings for wood products does not distinguish between Fire-Retardant Treated or Preservative Treated. Conditions as specified below shall take precedence over drawing notations. Where governing code authorities require Fire-Retardant Treatment in addition to conditions stated below or noted in the drawings, those authorities shall govern.

B. Fire-Retardant Treatment: In buildings of Types I-B, II-A, and II-B construction, all rough carpentry items shall be fire retardant treated in the following conditions:
1. All wood including but not necessarily limited to cants, nailers, shims, curbs, equipment support bases, blocking, and sheathing built into the roof or above the roof line. Use only preservative treatment formulated for exterior use.
2. Blocking, nailers, supports, shims or other wood construction within the building whether or not concealed within walls or above-celling shall be fire-retardant treated. For wood in contact with concrete slab-on-grade use only preservative treatment formulated for exterior use
3. Any wood Items indicated on the drawings as “Fire-Retardant Treated”.

C. Preservative Treatment: Install preservative treated wood in the following conditions:
1. All wood including but not necessarily limited to sills, sleepers, blocking, furring, stripping, and wood flooring nailers that are in contact with concrete slab-on-grade or built into exterior walls.
2. All wood framing, blocking, and furring members used in exterior construction except for Fire-Retardant Treated wood conditions as specified above.
3. All wood framing, blocking, furring, and roofing wood including cants, nailers, shims, curbs, equipment support bases, and sheathing used in concession buildings, toilet buildings, press box buildings, and similar free-standing separate ancillary buildings shall be Preservative Treated.

END OF SECTION

SECTION 06 20 24 – INTERIOR FINISH CARPENTRY AND MILLWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Miscellaneous wood or plastic laminate clad millwork items that are not included in Section 12 32 16 Plastic Laminate Clad Casework.
   2. Repair of Oak bullnose trim at edge of stage flooring.
   3. Oak trim support at dance room mirrors.

B. Related Sections
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood furring, blocking, shims, and hanging strips required for installing finish carpentry and millwork items.
   2. Section 12 32 16 - Plastic Laminate-Clad Casework.

1.2 REFERENCES

A. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of required furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Indicate wood type and finish of each piece of construction.

D. Samples:
   1. Submit three representative samples of each finish carpentry and millwork item, illustrating wood grain, edge and corner condition(s), and finish.

1.4 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for interior finish carpentry including wood grades, construction, finishes, and other requirements.

B. Surface Burning Characteristics for Fire Retardant Treated Items: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
   1. Where required by authority having jurisdiction, apply label from approved agency identifying each item.

1.5 QUALIFICATIONS

A. Installer Qualifications: An experienced installer who has completed finish interior carpentry similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing finish interior carpentry millwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect work from moisture damage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Comply with AWI requirements.

C. Maintain temperature and humidity conditions within ranges recommended by AWI. Do not deliver or install millwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

D. Allow materials to acclimate to temperature and humidity conditions recommended by AWI for minimum of 48 hours prior to installation. Maintain same conditions during and after installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with electrical rough-in and installation of associated and adjacent finishes.

C. Coordinate locations and requirements for blocking and backing for support and attachment of work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Laminate Surfacing: Comply with NEMA Standard GP50 high pressure laminated plastic as provided by Wilsonart, Formica, or Pionite. Provide 0.050-inch thick material at horizontal surfaces, and 0.030 inch thick laminate on exposed vertical surfaces. Provide backing sheet on bottom or concealed surfaces. Color(s) to be selected by the Architect from manufacturer’s full range.

B. Hardwood Plywood and Face Veneers: HPVA HP-1, Grade A, min 7-ply wood veneer core, face species to match hardwood lumber.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

C. Concealed Plywood: U.S. Product Standard PSI-66, 7-ply wood veneer core Douglas Fir plywood, grade trademarked DFPA, sanded. A-D grade. Use only in concealed areas or as core for plastic laminate. Use exterior grade at sink cabinets.

D. Hardwood Trim Support at Unframed Mirrors: Hard Rock Maple.
1. Grade: Clear.
2. Cut: Plain sawn.
3. Moisture Content: 12 to 14 percent.
4. Thickness: As indicated.
5. Width: As indicated.
6. Edge Condition: Square edges with radiused corners.
7. End Condition: 45-degree overlap.
8. Lengths: Minimum 8 ft.

E. Hardwood Treads, Risers, and Stringers: Hard Rock Maple to match stage flooring.
1. Grade: Clear.
2. Cut: Plain sawn.
3. Moisture Content: 12 to 14 percent.
4. Thickness: 3/4 inch or as indicated.
5. Width: As indicated.
6. Length: One-Piece.

2.2 ACCESSORIES

A. Fasteners and Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors in masonry walls.

B. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive.

C. PVC Edge Trim: Extruded rigid PVC; smooth finish, of width to match component thickness; standard or custom color as required to match plastic laminate; 1 mm and 3 mm thickness.

D. Glass: Clear tempered double strength, as specified in Section 08 80 00.

E. Fasteners and Anchors:
1. Fasteners: Hot dipped or Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

G. Concealed Joint Fasteners: Threaded steel.

H. Grommets:

1. Type: Plastic or nylon 2-1/2” diameter with flip-top tab in cap, in color(s) as selected by the Architect.

2. Locations: Where indicated on the drawings and where needed for data wiring to pass through counter tops, whether or not indicated.

3. Basis of Design: Model #EDP3 as manufactured by Doug Mocket & Co., 800-523-1269.

2.3 FABRICATION, GENERAL

A. Provide Custom grade interior millwork complying with the referenced quality standard. All work shall be of the highest quality workmanship thoroughly sanded and cleaned, free from tool marks, with all nails properly set, filled and sanded smooth. Moldings and trim shall be furnished in as long lengths as practicable. All pencil and chalk marks shall be removed.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate millwork to dimensions, profiles, and details indicated.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition millwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural millwork, examine shop-fabricated work for completion and complete work as required, including removal of packaging and.

3.2 MISCELLANEOUS MILLWORK INSTALLATION

A. Install miscellaneous millwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

B. Scribe and cut millwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

C. Anchor millwork to anchors or blocking built in or directly attached to substrates. Secure with concealed fasteners and blind nailing as required for complete installation.

D. Field Finishing:
1. Mask off adjacent surfaces before beginning sanding.
2. Sand to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
3. Apply filler and stain and three finish coats.
4. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
5. Apply second and successive coats. Allow to dry. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective millwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace millwork. Adjust joinery for uniform appearance.

B. Clean millwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 07 19 16 – CONCRETE FLOOR CLEAR FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water-based clear finish for interior concrete floors to remain exposed.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete slab-on-grade surfaces, curing agents, and floor hardeners.
   2. Section 07 90 00 - Joint Protection: Sealants

1.2 SYSTEM DESCRIPTION

A. Applied Finish: Material to restrict moisture absorption and provide slip-resistant and abrasion-resistant finished appearance for interior concrete flooring indicated to remain exposed.

B. Floor Hardener: Provided and installed under the Concrete Section. Ensure that floor hardeners are completely cured prior to applying finish product of this Section.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit details of product description, tests performed, limitations to coating, and chemical properties including percentage of solids.

C. Samples: Of each substrate indicated to receive water repellent, 12 inches square, with specified repellent treatment applied to half of each sample.

D. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention, and cautionary procedures required during application.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements, including local requirements controlling the emission of VOCs.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section for a minimum of three years.

B. Applicator: Company specializing in performing Work of this section with minimum three years’ experience and approved by manufacturer for this application.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect product from freezing.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply coating when ambient or surface temperature is lower than 40 degrees F or higher than 100 degrees F.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish manufacturer's written warranty for sealer/finish for a minimum of two-years after Substantial Completion of Project.

PART 2 - PRODUCTS

2.1 Manufacturers:
A. Euclid Chemical Company, www.euclidchemical.com.
B. L.M. Scofield Company, www.scofield.com
C. W.R. Meadows, www.wrmeadows.com
D. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Clear Finish: Water-based clear and colorless high solids type sealer and finish that is VOC-compliant.
1. Basis-of-Design: *Selectseal Plus* as manufactured by Scofield.
2. VOC Content: less than 100 g/L.
3. Semi-Gloss or Gloss finish.
4. High solids content; low odor.
5. Certified wet-slip resistant per UL 410.
6. Abrasion-resistant.
7. Apply at interior concrete floors scheduled to remain exposed.
8. Ensure compatibility with cured floor hardener provided under the Concrete Section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.

D. Obtain product information from Contractor for curing agent that was used on floors scheduled to receive a clear finish coat to ensure that the proposed finish coat is compatible.

E. Test the surface of concrete before applying sealer/finish to ensure it absorbs drops of water within 20-30 seconds. Verify with the sealer/finish manufacturer whether a non-absorbing surface will require mild acid-etching prior to sealer/finish application.

3.2 PREPARATION

A. Delay Work until concrete substrate is cured minimum of 60 days, and all other trades have completed work in the affected areas.

B. Remove loose particles and foreign matter. Remove oil or foreign substances that may interfere with appearance or performance of sealer/finish. Remove drywall compound and paint drips by scraping.

C. Remove curing agents remaining on surface of affected slabs. Ensure compatibility of curing agent and any installed joint sealants with proposed sealer/finish product.

D. Scrub and rinse surfaces with water and let dry while restricting foot traffic. Vacuum dry surface just prior to application of sealer/finish.

E. Test for pH level of substrate before applying. Do not apply to substrates with pH level outside of manufacturer's recommended limits.

F. Protect adjoining work, including sealant bond surfaces at joints. Mask-off wall bases and adjoining surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces.

G. Coordination with Sealants and Hardeners:

1. Coordinate with concrete hardener applied under the Cast-In-Place Concrete section to ensure compatibility.
2. Coordinate with sealant manufacturer to determine whether sealer/finish should be applied prior to or after installation of any joint sealants in concrete slab. Sealant joints installed prior to application of sealer/finish shall be fully cured.
3. Sealer/finish application may precede joint sealant installation only if sealant adhesion and compatibility have been tested and verified.

3.3 APPLICATION

A. Apply in accordance with manufacturer's instructions.

B. Apply a saturation coating of clear sealer/finish on indicated surfaces using foam, microfiber, or lamb's wood applicators. Cover all surfaces to remain exposed.

C. Apply second coat in accordance with manufacturer's directions for drying and scuffing of first coat. Final coat shall be free of lap or brush marks.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Immediately remove sealer/finish from adjacent surfaces by methods as instructed by coating manufacturer. Repair damage to surfaces not indicated to receive sealer/finish.

END OF SECTION

SECTION 07 21 13 – THERMAL WALL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Rigid board insulation at exterior masonry or steel stud cavity wall construction.
   2. Blanket insulation where specifically indicated at exterior parapets, soffits, or wall cavities.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Cavity wall construction.
   2. Section 07 27 26 – Fluid-Applied Membrane Air Barrier.
   3. Section 09 21 16 – Gypsum Board Assemblies: Gypsum sheathing board.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   2. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for product characteristics, performance criteria, and limitations.

   1. Provide product data indicating fire-test-response characteristics in accordance with the following, or similar testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Identify materials with appropriate markings of applicable testing and inspecting agency.
      b. Surface-Burning Characteristics tested per ASTM E84.
      c. Fire-Resistance Ratings tested per ASTM E119.
      d. Combustion Characteristics tested per ASTM E136.
   2. Provide product data indicating thermal characteristics.
   3. Provide coordinated submittal with Air Barrier system and/or other products required to be tested as part of an assembly for meeting requirements of NFPA 285-06.

C. Manufacturer's Installation Instructions: Submit special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
   1. Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.6 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence Work to ensure air barrier materials are successfully completed before beginning Work of this section.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources.
   1. Store inside and in a dry location.
   2. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
   3. Protect plastic insulation as follows:
      a. Do not expose plastic insulation to sunlight, except to extent necessary for period of installation and concealment.
      b. Protect against ignition at all times.
      c. Do not deliver plastic insulating materials to Project site before installation time.
      d. Once started, complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 CAVITY WALL BOARD INSULATION

A. Manufacturers
   1. Thermax; Dow Chemical USA, www.dow.com
   2. EnergyGuard; GAF Corp., www.gaf.com
   3. XCI Class A; Hunter Panels, www.hunterpanels.com
   4. EnergyShield PRO2: Atlas Wall Board, www.atlaswall.com
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Materials
   1. Polyisocyanurate Insulation Board meeting requirements of ASTM C1289-17 and NFPA 285-06:
   2. Board size: 16 x 96 inches.
   3. Board Thickness: 2-inches or as indicated in the drawings.
   4. Thermal Resistance: 5-year aged R-value of 5.7 per inch thickness or greater.
   5. Face Material: Type I foil face or Type II glass mat face as required to meet the specific requirements of ASTM C1289-17 and NFPA 285-06 for the tested insulation/air barrier assembly.

C. Applications:
1. Use at metal panel or masonry surfaced walls as required to meet NFPA 285-06.
a. Use only insulation board products that have been tested as an assembly with other specific products, including Air Barrier system, per NFPA 285-06. Coordinate with General Contractor to ensure products are submitted as part of a tested assembly.

2. Protection: All plastic insulation boards must be utilized, detailed, and protected in accordance with requirements of NFPA 285-06 and applicable governing authorities.

D. Accessories
1. Adhesive: Type recommended by insulation manufacturer for application. Ensure compatibility with applied air barrier material.

2.2 BLANKET INSULATION

A. Manufacturers:
1. CertainTeed Corporation www.certainteed.com
2. Johns Manville Corporation. www.jm.com
3. Owens Corning. www.owens-corning.com
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: ASTM C665; preformed glass fiber blankets; friction fit, conforming to the following:
1. Thermal Resistance: Minimum R-value of 19.
2. Thickness: 6 inches.
3. Width: 12 and 16 inches wide, as needed for the particular stud spacing.
4. Facing: Unfaced.

C. Applications:
1. Exterior stud wall cavities and parapets.
2. For special applications where specifically indicated in the drawings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

C. Verify wall ties are properly spaced and ready to receive insulation.

3.2 BOARD INSUALTION

A. Apply adhesive to substrate.

B. Install boards horizontally between wall ties.

C. Stagger end joints. Butt edges and ends tight to adjacent boards.

D. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

3.3 BLANKET INSULATION

A. Install only at areas where board insulation or loose fill insulation is not indicated.
1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place blankets in cavities formed by framing members to produce a friction fit

between edges of insulation and adjoining framing members.

3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
4. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cold applied water-resistant vapor permeable air barrier at exterior wall assemblies.

B. Related Sections include the following:
1. Section 04 20 00 “Unit Masonry Assemblies” for embedded flashings in masonry.
2. Section 07 21 13 “Thermal Wall Insulation” for wall insulation compatibility.
3. Section 09 21 16 “Gypsum Board Assemblies” for exterior sheathing board.

1.2 REFERENCES

A. ASTM International:
1. ASTM E 2178 - Standard Test Method for Air Permeance.
2. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
3. ASTM D 4541 – Standard Test Method for Pull-Off Strength of Coatings.
4. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
5. ASTM D 2369 – Standard Test Method for Volatile Content of Coatings.
6. ASTM D 4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
7. ASTM E 154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
8. ASTM E 162 Test Method for Surface Flammability of Materials Using a Radiant Heat Source.
9. ASTM E 1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
10 ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
11 ASTM C 920 Specifications for Elastomeric Joint Sealants.
12 ASTM C 1193 Guide for Use of Joint Sealants.
13 ASTM D 570 Test Method for Water Absorption of Plastics.
14 ASTM D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
15 ASTM D 1876 Test Method for Peel Resistance of Adhesives.
16 ASTM D 1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting.
17 ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
18 ASTM D 4258 Practice for Surface Cleaning Concrete for Coating.

1.3 SUBMITTALS

A. General Submittal Requirements: Reference Section 01 33 00 - Submittal Procedures.

B. Product Data: For each type of product specified, submit manufacturer’s product data, installation instructions, and manufacturer’s printed instructions for evaluating, preparing, and treating substrate, temperature, and other limitations of installation conditions, technical data, and tested physical and performance properties.
1. Obtain primary materials from a single manufacturer regularly engaged in manufacturing vapor permeable air barrier materials. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
2. Include statement that all proposed air barrier materials are permanently

chemically compatible with all proposed adjacent materials.
3. Include statement that successful field peel-adhesion tests on all materials to which sealants are proposed to be adhered have been performed.
4. Include statement that products comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

C. Quality Assurance:
1. Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification numbers of proposed installers.

D. Manufacturer's Installation Instructions:
1. Submit special procedures and perimeter conditions requiring special attention.
2. Submit requirements for conditions, preparation, and any details of construction required for substrates installed by other trades in order to provide substrate installations suitable for the work under this section.
3. Submit manufacturer's recommended dry film thickness installation of fluid-applied membrane for this specific Project.

1.4 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Install membrane air barrier to gypsum board sheathing as part of the unit masonry mock-up specified in Section 04 20 00.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Ensure that ambient temperatures are above 40 degrees F and below 100 degrees F for 24 hours before and during application and until membrane has cured.

C. Do not install liquid-applied membrane in snow, rain, fog, or mist or when such conditions are expected within 24 hours of completed application. Do not install liquid-applied membrane when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the vapor permeable air barrier manufacturer.

1.6 PERFORMANCE REQUIREMENTS

A. Material performance: Provide materials that have an air permeance not to exceed 0.004 cu. ft. per minute per sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/m^2@75 Pa.) when tested in in accordance with ASTM E-2178.

B. Assembly Performance: Provide a continuous vapor permeable air barrier assembly that has an air leakage not to exceed 0.040 cu. ft. per minute per sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (0.20 L/m^2@75 Pa.) when tested in in accordance with ASTM E-2357..
1. Assembly shall be capable of withstanding combined positive and negative design wind, fan, and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure.
2. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory vapor permeable air barrier materials at such locations, changes in substrate, and perimeter conditions.
3. Assembly shall not displace adjacent materials under full load.
4. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, and any anticipated seismic movement.

Connection shall be made between:
a. Foundation and walls.
b. Walls and windows or doors.
c. Different wall systems.
d. Wall and roof.
e. Wall and roof over unconditioned space.
f. Walls, floor and roof across construction, control and expansion joints.
g. Walls, floors and roof to utility, pipe and duct penetrations.

5. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

C. System is not suitable for waterproofing applications in hydrostatic condition.

D. System is not compatible with petroleum solvents, fuels and oils, materials containing creosote, pentachlorophenol, or linseed oil.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer’s name, product, date of manufacturer, and any special directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location within temperature range recommended by the manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer’s recommendations.

1.8 WARRANTY

A. Material Warranty: Provide Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in accordance with manufacturer's written instructions.
1. Failures include, but are not necessarily limited to the following:
a. Failure to maintain air permeance rating not to exceed .004 cfm/sq. ft (0.02 L/s/sq. m.) when tested per ASTM E2178, within specified warranty period.
b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Method B.
2. Warranty Period: Minimum of 5-years from date of Substantial Completion of the Project

B. Installer’s Warranty: Provide air barrier subcontractor’s material and installation warranty for a minimum of 2-years from date of Substantial Completion of the Project. Warranty shall cover all components of the air barrier assembly against failure including loss of airtight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

1.9 PRE-INSTALLATION CONFERENCE

A. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
1. Review of Submittals.
2. Review of surface preparation, minimum curing period and installation procedures.
3. Review of special details and flashings.
4. Sequence of construction, responsibilities and schedule for subsequent operations.

5. Review of mock-up requirements.
6. Review of inspection, testing, protection and repair procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer shall be a firm with a minimum of 10-years' experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
1. Grace Construction Products: *Perm-A Barrier VP.*
2. Henry Company, Inc.: *Air Bloc 31MR*
3. Sika Corporation: *Sikagard 530*
4. Tremco, Inc.: *ExoAir 220.*
5. W.R. Meadows, Inc.: *Air Shield LMP.*
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 SYSTEM COMPONENTS: Basis of Design: *Perm-A-Barrier* as manufactured by Grace Construction Products or approved equivalent by specified manufacturer

A. Fluid-Applied Membrane: Single component acrylic vapor-permeable air barrier membrane, resulting in minimum 30 mil dry thickness.
1. Basis of Design: *Perm-A Barrier VP* as manufactured by Grace Construction Products.
2. Air permeance: Less than 0.004 cfm/ft^2 per ASTM E2178.
3. Water vapor transmission: Not less than 11.2 perms (649.6 ng/Pa x s x sq. m); when tested in accordance with ASTM E96.
4. Pull adhesion to glass faced wall board: 25 psi or greater per ASTM D4541.
5. Tensile strength: 15 psi or greater per ASTM D412.
6. Solids content: Minimum 50% by volume or weight per ASTM D2369.
7. UV exposure limit: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.

B. Transition Membrane: *Perm-A-Barrier Detail Membrane*, fully adhered.

C. Through-Wall Flashing: *Perm-A-Barrier Wall Flashing*: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption: ASTM D570: max. 0.1% by weight
3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
4. Tear Resistance:
   a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
   b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)
7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.

D. Primer: Water based *Perm-A-Barrier Primer Plus* or *WB Primer*.

E. Penetrations, terminations, and detailing sealant: *Bituthene Liquid Membrane*.

F. Joint Sealant: As recommended by the primary system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of air barrier system. Verify items penetrating substrate are securely anchored and prepared to receive air barrier system.

C. Ensure the following conditions:
1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.
2. Concrete surfaces are cured and dry, smooth without large voids, loose aggregate, spalled areas, or sharp protrusions.
3. Masonry joints are full, flush, and completely filled with mortar, and all excess mortar on masonry ties has been removed.
4. Corners and edges of drywall sheathing panels are properly screw-fastened to avoid any deflection in the final membrane, and all fastener heads are driven flush with the panel surface.
5. Substrate dryness meets air barrier system manufacturer’s requirements. Test for capillary moisture in substrate by plastic sheet method according to ASTM D 4263.

D. Verify sealants used in sheathing installation are compatible with proposed air barrier membrane. Perform field peel-adhesion test on materials to which sealants are adhered.

E. Beginning air barrier system installation indicates acceptance of substrate conditions.

3.2 PREPARATION

A. During wall construction install embedded flashings including all membrane through-wall flashings where indicated and as necessary for successful air barrier installation. Install membrane flashing over vertical and horizontal legs of steel shelf angles and over transition between vertical leg and sheathing or CMU substrate.

B. Protect adjacent construction and surfaces not designated to receive air barrier system.

C. Clean loose dust and dirt from surfaces to receive air barrier system by brushing or use of a clean dry cloth.

D. Do not apply membrane or sealants to surfaces unacceptable to air barrier system manufacturer without corrective action.

E. Fill surface irregularities, voids, and joints in substrate as recommended by system manufacturer, with particular attention to expansion and construction joints. Remove any high spots to ensure uniform surface.

F. On highly dusty or porous substrates apply a scratch coat of liquid membrane prior to spraying to full thickness.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and protrusions.

H. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.3 INSTALLATION

A. General: Install transition strip materials and fluid-applied vapor-permeable air and liquid

water barrier to prevent air infiltration and exfiltration through the exterior wall construction without prohibiting the movement of water vapor through the wall.

1. Install materials in accordance with manufacturer's printed instructions, the approved submittals, and as specified herein.
2. Do not allow materials to come in contact with other chemically incompatible materials.

B. Reinforcement and Joint Treatments
1. Reinforce joints, corners, and changes in plane of substrate using air barrier system manufacturer's approved transition membrane and sealant.
2. Tape all vertical and horizontal joints in gypsum sheathing using 2-inch wide x continuous mesh wallboard tape or approved transition membrane as recommended by the system manufacturer. Joint gaps greater than 1/4" wide shall be filled with approved mastic or caulk and allowed to fully cure before application of tape. Ensure that open-mesh tape and any remaining joint gap is fully filled with specified-applied membrane material.

C. Priming:
1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Prime all wood, metal, painted and shop coated substrates.
2. Apply as many coats as necessary for proper adhesion.
3. Prime masonry or concrete substrates with conditioning primer for fluid-applied vapor permeable air barrier as recommended by system manufacturer. Apply as many coats as necessary for proper adhesion. Provide adequate drying time between coats.
4. Prime glass-fiber faced gypsum sheathing with number of coats as required to achieve proper bonding. Provide adequate drying time between coats.

D. Detailing:
1. Connect vapor permeable air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors, and other intersection conditions, and perform sealing of penetrations using accessory materials in accordance with system manufacturer's recommendations and approved submittals.
2. Transitions to beams, columns, and similar appurtenances shall be made with system manufacturer's transition membrane.
3. Apply transition strips and flashing to shed water naturally. Seal all sheet edges with permanently flexible termination mastic.
4. Install transition strips in shingle fashion so that any subsequent sheet overlaps sheet below by a minimum of 2-inches. Overlap horizontally adjacent transition strips a minimum of 2-inches. Roll overlaps into place using hand roller.
5. Seal all penetrations with termination mastic, extruded silicone sealant, membrane counter flashing or other material approved by the system manufacturer and the approved submittals.
6. At changes in substrate plane install approved transition material of sealant, mastic, membrane counter flashing or other material approved by the system manufacturer and the approved submittals. Eliminate all sharp 90-degree inside corners and provide a smooth transition from one plane to another.
7. At through-wall flashings provide an additional 6-inch wide strip of manufacturer's recommended membrane counter flashing to seal top of through-wall flashing to fluid-applied membrane. Seal top edge of strip with bead of approved sealant or mastic.
8. At expansion and control joints provide backup for the membrane to accommodate anticipated movement. Provide transition at all joint assemblies.
9. Apply a continuous bead or trowel coat of mastic along membrane seams at reverse-lapped seams, rough cuts, and as recommended by the manufacturer and

the approved submittals.

10. Membrane shall be continuously supported by substrate. Provide mechanically fastened non-corrosive sheet metal to span gaps in substrate plane and to make smooth transition from one plane to another.
11. At the end of each working day, seal top edge of self-adhered membrane to substrate with termination mastic.

E. Fluid-Applied Membrane:
1. Ensure that all detailing of wall and sheathing is completed prior to applying the full coverage of fluid-applied membrane.
2. Apply fluid-applied vapor permeable air barrier using spray equipment and methods as required to achieve a minimum dry film thickness as recommended by the system manufacturer and approved in the submittals.
3. Spray number of coats as required to achieve minimum dry film thickness as recommended by the system manufacturer and the approved shop drawings. Allow for required drying time between each coat.

3.4 CLEANING AND PROTECTING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and materials.

B. Inspect installation just prior to final covering of system, and repair punctures, tears, damaged areas, and inadequately lapped seams with patches of membrane lapped and sealed per manufacturer’s recommendations.

C. Coordinate scheduling with installation of cover materials to ensure that membrane is not exposed to sunlight longer than recommended by the system manufacturer. Board insulation shall not be installed until fluid-applied membrane is fully cured.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fabricated sheet metal items, including:
   1. Flashings and counter flashings: Reference roofing and masonry sections for additional requirements.
   2. Roof fascias and gravel stops: Reference roofing section for additional requirements.
   3. Miscellaneous metal trim for exterior systems.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Flashings embedded in masonry.
   2. Section 07 61 03 – Manufactured Sheet Metal Roofing.
   3. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

A. American Society of Civil Engineers:
   1. ASCE-7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:
   1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products.
   4. ASTM B32 - Standard Specification for Solder Metal.
   5. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   6. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

E. Single Ply Roofing Institute:
   1. SPRI ES-1 - Wind Design Guide for Edge Systems Used with Low-Slope Roofing Systems.

1.3 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install items of this Section to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the area wind zone pressures in accordance with ASCE-7 requirements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples: Submit two samples of each exposed metal finish.

E. Product Test Reports: Submit report based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings and roof edge flashings with performance requirements.

1.5 QUALIFICATIONS

A. Installer: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Finish Warranty for Prefinished Steel Sheet: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
   1. Finish Warranty Period: 20-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M coil coated.
   1. Base Metal: ASTM A653/A653M; Structural Quality; G90 zinc coating, minimum 24 gage thick.
   2. Exposed Finish: Minimum two coat fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin.
   3. Unexposed Finish: Manufacturer’s standard coating.

B. Stainless Steel: ASTM A240/240M; Type 304, dead soft fully annealed; smooth surface, Number 2D finish; minimum 26 gage thick.

2.2 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers. Match finish of exposed heads with material being fastened.

B. Underlayment: ASTM D226; Type II, No. 30 un-perforated asphalt felt.

C. Protective Backing Paint: FS TT-C-494, Bituminous.

D. Sealant: As specified in Section 07 90 00.

E. Plastic Cement: ASTM D4586, Type I.

F. Solder: ASTM B32; type suitable for application and material being soldered.

2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2-inch; miter and seam corners.

E. Form nonmoving seams with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. Form seams and joints in accordance with SMACNA standards.

F. Fabricate corners from one piece with minimum 18-inch long legs; seam and seal prefinished steel, solder stainless steel.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

H. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate gutters to rectangular profile as indicated on Drawings.

K. Fabricate downspouts to square profile, 4-1/2 x 4-1/2 inch size unless indicated otherwise.

L. Fabricate accessories in profile and size to suit gutters and downspouts:
1. Anchorage Devices: In accordance with SMACNA requirements.
2. Gutter Supports: Brackets and straps.
3. Downspout Supports: Straps.

M. Seal metal joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and nailing strips located.
1. Verify that wood nailers have been anchored in accordance with SPRI ES-1 requirements.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Paint concealed metal surfaces with protective paint to minimum dry film thickness of 15-mil.

3.3 INSTALLATION

A. Install sheet metal flashing and trim in accordance with SMACNA requirements.

B. Secure flashings in place using concealed fasteners wherever possible. Use exposed fasteners only where not exposed to public view.

C. Install flashings embedded in roofing system in accordance with roofing manufacturer's details and instructions to meet SPRI ES-1 requirements.

D. Install edge flashings in accordance with Section 07 54 05 to meet SPRI ES-1 requirements.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 18 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Secure gutters and downspouts in place.

H. Slope gutters minimum 1/4-inch per foot.

I. Seal metal joints watertight.

3.4 SCHEDULE

A. Scuppers: Stainless steel, 24-gage.

B. Gravel Stops and Fasciae: Two-piece snap-on edge flashings by roof membrane manufacturer.

C. Exposed Trim: Prefinished steel, 24-gage.

D. Counterflashings and Receivers: Stainless steel, 24-gage.

E. Roof Expansion Joints: Stainless steel, 24-gage.

F. Equipment Support and Roof Penetration Flashing: Stainless steel, 24-gage.

END OF SECTION

SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Spray-on cementitious fireproofing for interior exposed and concealed structural steel where indicated.

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 21 00 - Steel Joist Framing.
3. Section 07 84 00 - Firestopping.

1.2 REFERENCES

A. ASTM International:
1. ASTM C847 - Standard Specification for Metal Lath.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
4. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
5. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
6. ASTM E760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
7. ASTM E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
9. ASTM E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
10. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Applied (Sprayed-On) Fireproofing Systems: Provide fire rated assembly ratings as indicated on Drawings.

B. Air Erosion: Maximum 0.025 gram/sq. ft allowable weight loss of fireproofing when tested in accordance with ASTM E859.

C. Corrosion: No contribution to corrosion of steel test panels when tested in accordance with ASTM E937.

D. Mold Resistance: Material to show resistance to fungi growth when tested in accordance with ASTM C665 requirements for fungi resistance of insulation or ASTM G21.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Submit data for each type of fireproofing specified, indicating product characteristics, performance criteria, and limitations of use.

C. Product Data: Submit data for each type of fireproofing specified, indicating product characteristics, performance criteria, and limitations of use.

D. Test Reports: Indicate the following:
1. Compressive Strength: ASTM E761.
2. Dry Density: ASTM E605.
3. Bond Strength of Fireproofing: ASTM E736.
4. Bond Impact: ASTM E760.
5. Fire test reports of fireproofing application to substrate materials, including primers, similar to Project conditions, conducted in conformance to ASTM E84 and ASTM E119.
6. Air Erosion: ASTM E859.
7. Corrosion: ASTM E937.
8. Mold Resistance: ASTM C665 or ASTM G21.

E. Manufacturer's Installation Instructions: Submit information including special procedures, and conditions requiring special attention.

F. Manufacturer's Certificate: Certify applied fireproofing products meet or exceed specified requirements.
1. Certify applied fireproofing products contain no asbestos or other finely-divided particulate matter that can be released as airborne health hazard during or after application.

G. Manufacturer's Field Reports: Indicate compliance with manufacturer’s installation instructions and Contract Documents.

1.5 QUALITY ASSURANCE

A. Fireproofing Assembly: Rating as indicated on Drawings.
1. Tested Rating: Determined in accordance with ASTM E119.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section, with minimum three years’ experience.

B. Applicator: Company specializing in performing Work of this section, with minimum three years’ experience and approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain minimum ambient and substrate temperature of 40 degrees F during and for minimum 24 hours after application of fireproofing, unless otherwise recommended by manufacturer.

C. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

1.9 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence Work in conjunction with placement of masonry anchors and ties, partition track, and mechanical component hangers.

C. Provide temporary enclosure as required to confine spraying operations and protect the environment.

D. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

E. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

F. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.

G. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.

H. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

I. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

J. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
   2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LOWER BOND STRENGTH SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Manufacturers:
   1. Carboline Co., Pyrocrete www.carboline.com
   2. W. R. Grace & Co., Monokote Type MK-6/HY www.grace.com

3. Isolatek International Corp., Cafco 300 www.cafco.com
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Application: Allowed for concealed (protected) sprayed fireproofing for buildings under 75 ft. in height.

C. Product Description:
1. Low Density Cementitious Type: Factory mixed, cementitious material blended for uniform texture with vermiculite or lightweight synthetic aggregate, and conforming to the following requirements:
a. Type: As recommended by manufacturer for concealed interior applications.
b. Compressive Strength: ASTM E761, minimum 5.21 psi.
c. Dry Density: ASTM E605, minimum average density of 15 lb/cu ft.
d. Bond Strength: ASTM E736, 150 psf when set and dry.
e. Bond Impact: ASTM E760, no cracking, flaking or delamination.

2.2 HIGHER BOND STRENGTH SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Manufacturers:
1. Carboline Co., Pyrocrete 241 www.carboline.com
2. W. R. Grace & Co., Monokote Type Z106 www.grace.com
3. Isolatek International Corp., Cafco 400 www.cafco.com
4. Pyrok, Inc., Pyrok-MD www.pyrokinc.com
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Application: Required for exposed (unprotected) fireproofing for buildings under 75 ft. in height, and for sprayed fire proofing at all levels in buildings 75 ft. to 420 ft. in height.

C. Product Description:
1. Medium Density Cementitious Type: Factory mixed, Portland cement blended for uniform texture with mineral aggregates or mineral fibers and additives, without chlorides, approved for exterior use and conforming to the following requirements:
a. Type: As recommended by manufacturer for exposed interior applications, and for concealed exterior use.
b. Compressive Strength: ASTM E761, minimum 51 psi.
c. Dry Density: ASTM E605, minimum density of 22 lb/cu ft.
d. Bond Strength: ASTM E736, 434 psf when set and dry.
e. Bond Impact: ASTM E760, no cracking, flaking or delamination.

2.3 ACCESSORIES

A. Primer, Adhesive, Bonding Agent, and Topseal as recommended by fireproofing manufacturer.

B. Metal Lath: Expanded metal lath where required for cementitious fireproofing; 3.4 lb/sq ft, galvanized finish; conform to ASTM C847.

C. Water: Clean, potable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive fireproofing.

C. Verify clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

D. Verify ducts, piping, equipment, or other items interfering with application of fireproofing have not been installed.

E. Verify voids and cracks in substrate have been filled. Verify projections have been removed where fireproofing will be exposed to view as finish material.

F. Verify roof traffic has ceased and roof mounted equipment is in place.

G. Ensure that all steel members and sections scheduled to receive fireproofing have been properly prepared by the fabricator to receive the specified fireproofing application.

3.2 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials affecting bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION - SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Install metal lath over steel members as required by fire rated assembly Design Numbers.

B. Apply primer or adhesive as required by fireproofing manufacturer for conditions encountered.

C. Apply fireproofing in sufficient thickness to achieve required fire ratings, with as many passes as necessary to cover with monolithic blanket of uniform density and texture.

D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

E. Patch damaged work.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

C. Independent Testing Agency To:
1. Inspect fireproofing substrates prior to application of fireproofing for surface temperature and surface preparation in accordance with manufacturer's instructions.
2. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
3. Test frequency and type in accordance with applicable code and authorities having jurisdiction.
4. Inspect for the following:
   a. Installed Thicknesses and Density: ASTM E605.
   b. Bond Strengths: ASTM E736.
5. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.5 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

B. Observe site conditions, conditions of surfaces and installation, quality of workmanship, and

initiate instructions when necessary.

C. Manufacturer's Field Reports: Document above observations; include environmental conditions under which fireproofing materials were installed.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess material, overspray, droppings, and debris.

C. Remove fireproofing from materials and surfaces not required to be fireproofed.

D. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Penetrations and sealant joints in smoke barriers or fire-resistance rated wall, floor, and roof construction that are not covered under related sections in Divisions 21, 22, 23, 26, 27, or 28.

B. Protection Provided Under Other Sections – Where no reference to protection of penetrations is provided under the following Sections or their related drawings, then such protection shall be provided under the requirements of this Section 07 84 00:
   1. Division 4 Sections – Masonry and mortar used for fireproofing and firestopping.
   2. Division 9 Sections – Drywall systems and accessories used for fireproofing and firestopping.
   3. Division 21 Sections – Penetrations by fire suppression piping.
   4. Division 22 Sections – Penetrations by plumbing piping.
   5. Division 23 Sections – Penetrations of HVAC equipment including ducting, wiring, and piping.
   6. Division 26 Sections – Penetrations of electrical equipment including raceways, conduit, boxes, outlets, panels, and cabinets.
   7. Division 27 Sections – Penetrations of communication and technology equipment including wiring, conduit, outlets, panels, and boxes.
   8. Division 28 Sections – Penetrations of electronic safety and security equipment including wiring, conduit, outlets, panels, and boxes.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. A qualified inspection agency shall check installed firestopping systems for compliance with requirements.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60

degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1) UL in its "Fire Resistance Directory”.
2) Intertek Group in its "Directory of Listed Building Products."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Subject to compliance with requirements, provide products by one of the following
a. 3M Fire Protection Products, www.3m.com/
b. A/D Fire Protection Systems Inc., www.adfire.com/
c. HILTI, Inc., www.us.hilti.com/engineering
d. HOLDRITE, http://holdrite.com/
e. NUCO Inc., http://sealantcentre.com/
f. Passive Fire Protection Partners, www.firestop.com/
g. RectorSeal, www.rectorseal.com/
h. Specified Technologies, Inc., www.stifirestop.com/
i. STC Architectural Products, www.stcsoundseal.com/
j. Tremco, Inc., www.tremco.com

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479 , based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. Ratings in "T-Rating" Subparagraph below indicate resistance to excessive thermal transmission.
3. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
4. Unrated Assemblies: An approved fill, void or cavity material that is, 1) tested in the form and manner intended for use to demonstrate that it will stay in place, 2) classified for use in through-penetration firestop systems. Firestopping is required in the annular space between

the face of the penetrating item and the face of the floor opening, to resist the passage of flame and the products of combustion.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.]

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Retain accessories in subparagraphs below required.
   2. Permanent forming/damming/backing materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer

speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications. For this job, firestopping is required at all penetrations in all floors, rated and unrated, and includes, but is not limited to pipes, cables and conduits. Due to the variable and complex nature of what is required by the Building Code for unrated floors, and the desire to simplify the job with a single requirement, all penetrations in both unrated floors and rated floors are required to be treated with firestopping material, including penetrations within rated “shafts”. Any firestopping within rated “shafts” is not required to be rated, as the rated “shaft” will provide the rated separation of atmospheres between floors. If a penetration exits a “shaft” terminus at a floor, the penetration firestopping at the floor penetration shall be rated equal to the higher rating of either the rated “shaft” or the floor.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
4. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet. Where structural bays are shorter than 30 wide, locate wall identification at each structural bay, or fraction of structural bay width.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 90 00 - JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing, pre-compressed foam sealers, and accessories for building expansion joints, control joints, and joints between dissimilar materials where not a part of work specified under other sections. Sealant for specified systems such as roofing, waterproofing, air barriers, firestopping, glazing, sidewalks, paving, plumbing, etc. is provided under those sections.

B. Sections Related to Work Under This Section:
1. Section 03 30 00 – Cast-In-Place Concrete: Sealant at expansion and control joints in interior and exterior walls, and in exposed interior concrete floors.
2. Section 04 20 00 – Unit Masonry Assemblies: Sealant at expansion and control joints.
3. Section 08 11 13 – Standard steel Doors and Frames: Perimeter sealant at interior and exterior door frames.
4. Section 08 41 13 – Aluminum Framed Entrances and Storefronts: Perimeter joints
5. Section 08 91 00 - Louvers: Perimeter joints between louvers and adjacent materials.
6. Section 09 21 16 - Gypsum Board Assemblies: Joints between drywall assemblies and adjacent materials.

C. Sealant Work Specified in Other Sections:
1. Section 06 20 23 – Finish Carpentry and Millwork: Sealant between millwork assemblies and adjacent materials.
2. Section 07 13 00 – Sheet Waterproofing: Sealant at below-grade waterproofing systems.
3. Section 07 62 00 – Sheet Metal Flashing and Trim: Sealant as part of metal flashing systems.
4. Section 07 84 00 - Firestopping: Sealant as part of firestopping assemblies.
5. Section 07 92 00 – Roofing Related Joint Sealants.
6. Section 08 80 00 - Glazing: Glazing sealants.
7. Section 09 21 16 - Gypsum Board Assemblies: Acoustic sealant at drywall partitions.
8. Section 09 30 00 – Tiling: Sealant as part of tiling systems, including expansion and control joints.
9. Section 12 32 16 – Plastic Laminate-Clad Casework: Sealant between casework assemblies and adjacent materials.
10. Division 22 Sections: Sealants as part of plumbing systems and fixture installations.
11. Division 32 Sections: Sealants at paving and sidewalk joints.

1.2 REFERENCES

A. ASTM International:
1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM C1193 - Standard Guide for Use of Joint Sealants.
4. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
5. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
6. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years' experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp. www.dowcorning.com.
2. GE Silicones www.gesilicones.com.
3. Pecora Corp. www.pecora.com.
4. Sika Corp. www.sikaconstruction.com.
5. Tremco Sealants & Waterproofing www.tremco.com.
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 EXTERIOR SEALANTS:

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
5. Color: To be selected by Architect from manufacturer's standard range.
6. Service Temperature Range: minus 65 to 180 degrees F.
7. Applications: Use for:
   a. Exposed exterior joints between metal wall panels.
   b. Joints between unframed edges of glass panels without vertical mullions.
   c. Perimeter joints separating metal door frames, window frames, and louvers, vents and similar items from exterior wall materials.
8. Manufacturers:
   a. Basis of Design: Dow Chemical Company;
      1) DOW 795 Silicone Building Sealant: Required for all exposed building sealant joints including masonry control and expansion joints, perimeter frame joints. May be used other concealed applications such as setting of

thresholds and sill plates, or as substitute for butyl or polyisobutylene below. Color(s) selected by the Architect from manufacturer's minimum of 15 colors.

b. Pecora Corporation; Pecora AVB Silicone: www.pecora.com.
c. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing (or specified silicone above).
1. Type: Butyl Sealant manufactured by Tremco.
2. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.

2.3 INTERIOR SEALANTS:

A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
1. Type: Tremflex 834 manufactured by Tremco.
2. Color: Standard colors matching finished surfaces.
3. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
4. For interior control joints in brick, unpainted concrete masonry, cast stone, or stone, use General Purpose Exterior Sealant.

B. General Purpose Interior Traffic Bearing Sealant: Polyurethane; ASTM C920, Type S, Grade P, Class 50, Use T; single- component, semi self-leveling.
1. Type: Vulkem 45 SSL manufactured by Tremco.
2. Color: Standard colors matching finished surfaces.
3. Applications: Use for interior pedestrian traffic bearing joints

2.4 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
1. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
2. Prime for every sealant joint – no exceptions.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve the following:
1. Width/depth ratio of 2: 1.
2. Neck dimension no greater than 1/3 of joint width.
3. Surface bond area on each side not less than 75 percent of joint width.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

G. Pre-compressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF SECTION

SECTION 07 95 00 - PREMANUFACTURED EXPANSION JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following types of metal expansion joint covers:
   1. Interior pedestrian traffic joints.
   2. Interior wall and ceiling joints.
   3. Interior soffit joints.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Block-outs and cast-in anchorage and frames for expansion joint systems in concrete floors, parking decks, and walls.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim: Sheet metal roof and wall joint systems.
   3. Section 07 90 00 - Joint Protection; Elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.2 DEFINITIONS

A. Expansion Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and applied sealants.

B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

D. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.

E. Revise below if it is impossible either to indicate nominal joint widths based on a prediction when the joint system will be installed or, if none is indicated, to establish them based on maximum and minimum joint widths.

F. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when expansion joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide factory-fabricated expansion joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
   1. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
   2. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
   3. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
   4. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
   5. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
   6. Seismic Joints: Remain in place on exposure to seismic activity (movement).
   7. Joints in Surfaces with Architectural Finishes: Serve as finished expansion joint closures.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

B. Shop Drawings: For each joint system specified, provide the following:
   1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. Samples for Verification: Full-size units 6 inches (150 mm) long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

D. Product Test Reports: From a qualified testing agency indicating expansion joint systems comply with requirements, based on comprehensive testing of current products.

E. Research/Evaluation Reports: Evidence of expansion joint system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain expansion joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per ASTM E 119 and UL 2079, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: The design for each expansion joint system specified in Part 2 "Expansion Joint Systems" Article below is based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers listed.

2.2 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 EXPANSION JOINT SYSTEMS

A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
3. Public Arena Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces and complying with ADA guidelines for public areas.
4. Nominal Joint Widths: As indicated.
5. Type of Movement Capability: Expansion and contraction.
6. Preformed Seal Material: Manufacturer's standard.
a. Seal Color: Selected by Architect.
7. Exposed Frame Material: Aluminum.
8. Fire-Resistance Ratings: For joint systems at rated conditions, provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

B. Basis-of-Design Products: The design for each expansion joint system specified below is based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the following manufacturers:
1. Architectural Art Manufacturing, Inc. www.archart.com
2. Balco Metalines, www.balcousa.com
3. Construction Specialties, Inc. www.c-sgroup.com
4. InPro Corp. www.inprocorp.com.
5. MM Systems, Inc. www.mmsystemscorp.com

C. Expansion Joint System: Metal frames and preformed seals for the following interior conditions:
1. Floor-to-Floor Joints, Basis-of-Design Product: Construction Specialties, Inc.; “ALS” Series.
2. Floor-to-Wall Joints, Basis-of-Design Product: Construction Specialties, Inc.; “ALSW” Series.
3. Wall-to-Wall Joints, Basis-of-Design Product: Construction Specialties, Inc.; “AFW” Series.
4. Wall-to-Ceiling Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCSC” Series
5. Ceiling-to-Ceiling Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCS” Series.
6. Wall-to-Soffit Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCSC” Series.
7. Soffit-to-Soffit Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCS” Series.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Mill Finish: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing

is required to remove scratches, welding, or grinding produced in fabrication process.
1. Provide at floor conditions unless otherwise indicated.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
1. Provide at wall, ceiling, and soffit conditions unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to expansion joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing expansion joint assemblies and materials, unless more stringent requirements are indicated.

B. Coordinate installation of expansion joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
4. Locate wall, ceiling, and soffit covers in continuous contact with adjacent surfaces.
5. Securely attach in place with required accessories.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

D. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

E. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
4. Seal transitions according to manufacturer's written instructions.

F. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard

lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.

G. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 08 11 13 - STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Steel frames for doors, sidelights, and windows.
2. Interior and exterior steel doors.

B. Related Sections:
1. Section 08 14 16 - Flush Wood Doors: For wood veneered or plastic laminate clad doors set in steel frames.
2. Section 08 71 00 - Door Hardware: For finish hardware requirements of steel doors and frames.
3. Section 08 80 00 – Glazing: For glazing panels set in steel frames and glass lights set in steel door faces.
4. Section 09 90 00 - Painting and Coating: Field painting of shop-primed steel doors and frames.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E413 - Standard Classification for Rating Sound Insulation.

C. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Steel Door Institute:
1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

E. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, frame elevations, internal reinforcement, anchor types and spacing, door closure method, and cut-outs for hardware, glazing, and louvers.

C. Product Data: Submit door configurations, frame configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Oversize Construction Certificates: For door assemblies required to be fire rated and exceeding size limitations of labeled assemblies.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Fire Rated Door and Frame Construction: Conform to NFPA 252.

C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.

D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door and frame.

E. Surface Burning Characteristics:
1. Foam Insulation in Fire Rated Doors: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
2. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years' experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors and frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

C. Coordinate installation to accommodate door hardware electric wire connections.

PART 2 - PRODUCTS

2.1 STANDARD STEEL DOORS AND FRAMES

A. Manufacturers:
1. Amweld Building Products www.amweld.com
2. Ceco Door www.cecodoor.com
3. Curries www.curries.com
4. Deansteel Manufacturing, Inc. www.deansteel.com
5. Kewanee Corporation www.kewaneecorp.com
6. Mesker Door, Inc. www.meskerdoor.com
7. Pearland Industries
8. Pioneer Industries Inc. www.pioneerindustries.com
9. Republic Doors and Frames www.republicdoor.com
10. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Product Description - Doors: To suit ANSI A250.8 and the following:
1. Exterior Doors (Insulated): Level 3 - Extra heavy Duty, Model 2, seamless design, 14-gage face sheets, 1-3/4 inches thick, galvanized A60.
2. Interior Doors (Non-Rated): Level 3 - Extra heavy Duty, Model 2, seamless design, 16-gage face sheets, 1-3/4 inches thick, ungalvanized.
3. Interior Doors (Fire Rated): Level 3 - Extra heavy Duty, Model 2, seamless design, 16 gage face sheets, 1-3/4 inches thick, ungalvanized.

C. Product Description - Frames: Fully welded steel frames, to suit ANSI A250.8 and the following:
   1. Exterior: Level 3 - Extra heavy Duty, 14-gage thick material, galvanized A60.
   2. Interior: Level 3 - Extra heavy Duty, 16-gage thick material, ungalvanized.
      a. Furnish 14 gage thick material for frames over 48 inches wide.

2.2 DOOR COMPONENTS

A. Face: Steel sheet in accordance with ANSI A250.

B. End Closure: Channel, 0.04 inches thick, flush.

C. Core: Manufacturer’s standard core consisting of one of the following (no honeycomb):
   1. Polyurethane.
   2. Polystyrene foam.
   3. Mineral fiberboard.

D. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C236 or ASTM C976 on fully operable door assemblies.
   1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

2.3 FRAME COMPONENTS

A. Frames: Steel sheet in accordance with ANSI A250.

2.4 ACCESSORIES

A. Removable Stops: Rolled steel, channel shape, butted corners; prepared for countersink style screws.

B. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

C. Primer: ANSI A250.10, manufacturer’s standard rust inhibitive type.

D. Silencers: Specified in Section 08 71 00; resilient rubber fitted into drilled hole.

2.5 FABRICATION

A. Doors:
   1. Fabricate doors with hardware reinforcement welded in place.
   2. Glazing Stops: Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass.
   3. Attach fire rated label to each fire rated door.

B. Frames:
   1. Fabricate frames as welded unit.
   2. Mullions for Double Doors: Removable, specified in Section 08 71 00.
   3. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
   4. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
   5. For frames installed in masonry walls, and which will receive stop-applied seals or weatherstripping, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of the seals and weatherproofing.
   6. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors.
   7. Attach fire rated label to each fire rated frame.
   8. Glazing Stops: Provide non-removable stops on the outside and removable, screw-applied stops on the room side of doors and frames for glass.

C. Acoustical Ratings:
   1. Fabricate doors not scheduled as “Acoustical Door” to provide an STC rating of 33

or better.

2.6 SHOP FINISHING

A. Primer: Baked-on shop primer, ready for field finish painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

3.2 FRAME INSTALLATION

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with masonry and gypsum board wall construction for anchor placement.

C. Provide at least three wall anchors per jamb. For openings 90 inches or more in height, install four wall anchors per jamb.

D. Coordinate installation of glass and glazing specified in Section 08 80 00.

E. Coordinate installation of frames with doors and with hardware specified in Section 08 71 00.

F. Coordinate installation of frames with installation of doors specified in Section 08 14 16.

3.3 DOOR INSTALLATION

A. Install doors in accordance with ANSI A250.8.

B. Install door louvers and glazing frames plumb and level.

C. Coordinate installation of glass and glazing specified in Section 08 80 00.

D. Coordinate installation of doors with frames and with hardware specified in Section 08 71 00.

E. Touch-up damaged shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

C. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

D. Clearances for Fire-Rated Doors: In accordance with NFPA 80.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Flush wood doors with plastic laminate faces.

B. Related Sections:
   1. Section 08 11 13 - Standard Steel Doors and Frames: Steel frames.
   2. Section 08 71 00 - Door Hardware: Finish hardware requirements for doors.
   3. Section 08 80 00 – Glazing: Glass lights set in door faces.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E413 - Standard Classification for Rating Sound Insulation.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. Intertek Testing Services (Warnock Hersey Listed): Not applicable.

D. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

E. National Fire Protection Association: Not applicable

F. Underwriters Laboratories Inc.: Not applicable

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, identify cutouts for glazing and louvers.

C. Product Data: Submit information on door core materials and construction.

D. Samples:
   1. Submit two samples of door construction, 12 x 12 inch in size, cut from top corner of door.
   2. Submit two samples of plastic laminate illustrating laminate pattern and color.
   3. Submit two samples of lite opening frames, 6 inches long, for each material, type, and finish required.

E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWI Quality Standard Section 1300, Custom Grade.

B. Finish doors in accordance with AWI Quality Standard Section 1500.

C. Fire Rated Door Construction: Conform to NFPA 252.

D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three-years’ experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package, deliver and store doors in accordance with AWI Section 1300.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.
   1. Break seal on site to permit ventilation.

1.7 PROJECT CONDITIONS

A. Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Include coverage for delamination, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Furnish manufacturer’s “Life of Installation” warranty for interior doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. Algoma Hardwoods Inc. www.algomahardwoods.com
   2. Eggers Industries www.eggersind.com
   3. Graham Manufacturing Corp. www.grahamdoors.com
   4. IPIK Door Company www.ipikdoor.com
   5. Marshfield Door Systems Inc. www.marshfielddoors.com
   6. VT Industries www.vtindustries.com
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Solid core flush wood doors; 1-3/4 inches thick, five ply construction, plastic laminate facing material; fire and acoustic rated as indicated on Drawings.

2.2 COMPONENTS

A. Plastic Laminate Doors: Solid core, 5-ply construction, AWI Section 1300, core as follows:
   1. Non-Rated: Structural composite lumber core.
   2. 20- and 45-Minute Rating: Structural composite lumber core.
   3. 60-Minute Rating: Agri-fiber core.
   4. 90-Minute Rating: Mineral core.

B. Special Construction for Mineral Core Fire Doors: Not applicable.

C. Acoustical Doors: Not applicable.

D. Plastic Laminate Facing (Interior): NEMA LD-3, General Purpose Type, 0.050-inch-thick, type as indicated on Drawings.

E. Cross Banding Behind Laminate Finish: 1 ply; manufacturer's standard construction.

F. Facing Adhesive: Type II - water resistant.

2.3 ACCESSORIES

A. Glazing Stops - Plastic Laminate-Clad Doors:
1. Rolled steel, factory primed frames.

2.4 FABRICATION

A. Fabricate doors in accordance with AWI Quality Standards requirements.

B. Furnish lock blocks at lock edge and top of door for hardware reinforcement.

C. Vertical Exposed Edge of Stiles: Hardwood painted or stained to match laminate for plastic laminate doors.

D. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.

E. Factory fit doors for frame opening dimensions identified on shop drawings.

F. Provide edge clearances in accordance with AWI 1300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with AWI Quality Standards requirements.

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to maximum of 3/4 inch.
1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

D. Machine cut doors for hardware installation.

E. Coordinate installation of doors with installation of frames specified in Section 08 11 13 and hardware specified in Section 08 71 00.

F. Coordinate installation of glass and glazing specified in Section 08 80 00.

3.3 INSTALLATION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI requirements for fit and clearance tolerances.

C. Conform to AWI Section 1300 requirements for maximum diagonal distortion.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust door for smooth and balanced door movement.

C. Adjust closer for full closure.

END OF SECTION

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire resistive rated and non-rated access doors and panels with frames.
   1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
   2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.

1.2 REFERENCES

A. ASTM International: ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Intertek Testing Services (Warnock Hersey Listed): WH - Certification Listings.

C. National Fire Protection Association: NFPA 80 - Standard for Fire Doors, Fire Windows.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate exact position of access door units.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 QUALITY ASSURANCE

A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B. Fire Rated Access Doors: Rating as indicated on Drawings.
   1. Tested Rating: Determined in accordance with ASTM E119.

C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. J. L. Industries.
   2. Karp Associates, Inc.
   3. Milcor LTD, Partnership.
   4. Nystrom Products Co.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Flush Framed Access Doors: Frames and nominal 1-inch wide exposed flanges of 16-gage

steel and door panels of 14-gage steel (see Finishes for stainless steel).

C. Gypsum Board Access Doors: Frames and nominal 1-inch wide flanges of 16-gage steel and door panels of 14-gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 21 16.

D. Plaster Access Doors: Frames and nominal 1-inch wide flanges of 16-gage steel and door panels of 14-gage steel. Design flanges to be concealed by plaster specified in Section 09 24 00.

E. Fire Rated Access Doors: Frames and nominal - inch wide exposed flanges of minimum 16-gage steel and door panels of 20-gage steel. Provide self-closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

F. Gypsum Board Fire Rated Access Doors: 16-gage steel frames with minimum 22-gage galvanized steel drywall bead flanges and door panels of 20-gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 21 16. Provide self-closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

2.2 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.

B. Wall and Ceiling Access Door and Panel Hardware:
1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock.

C. Size Variations: Obtain acceptance of manufacturer’s standard size units which vary slightly from sizes shown or scheduled.

2.3 FINISHES FOR PANELS AND FRAMES

A. Stainless Steel: Provide series 300 brushed stainless steel panels and frames for all restrooms.

B. Painted Panels and Frames
1. Base Metal Protection: Galvanized, hot dipped wiped coat finish.
2. Shop Finish: Factory powder coat or baked enamel finish. Color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for access doors and panels are correctly sized and located.

3.2 INSTALLATION

A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
1. Set concealed frame type units flush with adjacent finished surfaces.

B. Position unit to provide convenient access to concealed work requiring access.

C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

END OF SECTION

SECTION 08 33 23 – OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Exterior double-face insulated manual overhead coiling doors.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Support framing.
   2. Section 09 90 00 - Painting and Coating: Field paint finish of support framing and miscellaneous steel.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.

B. Deflection: Design exterior door assembly to withstand wind/suction loads indicated on Drawings, with maximum deflection of 1/120, and without damage to door shutter or assembly components.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

C. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

   1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

   2. Submit general construction, component connections and details, description of factory finishes

   3. Summary of forces and loads on walls and jambs.

D. Samples: Submit two door slats, 12 inches long, illustrating shape, color and finish.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, and adjustment and alignment procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Submittal shall be sealed and signed by a professional structural engineer licensed to practice in the state of Texas. Sealed submittal shall include all design wind loading.

H. Closeout Submittals
   1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

2. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

C. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

D. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum years' experience and approved by manufacturer.

1.6 WARRANTY

A. Provide 1-year warranty covering defects in labor and materials, including installation and operation.

B. Provide manufacturer's written 10-year warranty covering deterioration of finish, rusting, and delamination.

PART 2 - PRODUCTS

2.1 OVERHEAD COILING DOORS

A. Manufacturers:
1. Clopay Building Products Co., www.clopay.com/bpc/index.html
2. Cornell Iron Works Inc. www.cornelliron.com
3. McKeon Rolling Steel Door Company, Inc. www.mckeondoor.com
4. Overhead Door Corporation. www.overheaddoor.com
5. Raynor Garage Doors. www.raynor.com/index.cfm
6. Southwestern Steel Rolling Door Co.
7. Windsor Door www.windsordoor.com.
8. Substitutions: Section 01 60 00 - Product Requirements.

2.2 EXTERIOR DOORS

A. Curtain for Exterior Doors: Conforming to the following:
1. Steel Slats: Double-faced interlocking ASTM A653/A653M steel, with galvanized coating designation G90 and factory powder coat factory finish. Exterior face minimum 20-gage.
a. Type: Sandwich slat construction with insulated core.
b. Color: As selected by the Architect from manufacturer's standard colors.
2. Nominal Slat Size: 2 inches wide x required length.
3. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
4. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets

or high-strength nylon, as required to comply with wind load.

5. Curtain Bottom: Fitted with minimum 1-1/2 x 1-1/2 x 1/8-inch angles to provide reinforcement and positive contact with floor in closed position; galvanized.
   a. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door.
   b. Obstruction Sensing Safety Edge: In the event the safety edge meets an obstruction during closing, the shutter will stop, reverse, and return to the open position.
   c. During self-closing, shutter will stop until obstruction has been removed, and then continue closing.
6. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane foam-type thermal insulation complying with maximum flame spread and smoke developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.

B. Operation: Manual chain and sprocket operated.

2.3 GENERAL

A. Guides: Minimum 3/16 inch thick; galvanized steel conforming to ASTM A653/A653M, minimum galvanized coating designation G90 in accordance with ASTM A924/A924M.
   1. Furnish continuous angles of profile to retain door in place; mounting brackets of same metal. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension.

B. Hood Enclosure: Round shape, minimum 24 gage galvanized steel; internally reinforced to maintain rigidity and shape.

C. Mounting Tube Frame: Provide manufacturer's standard mounting tube frame designed to support grille; factory fabricated from structural-steel tubes; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.4 SHOP FINISHING

A. Curtain Slats: Factory powder coat finish, color as selected.

B. Guides and Hood Enclosure: Prime for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

A. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

B. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

C. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 00.

D. Install perimeter trim and closures.

3.3 ERECTION TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent Work.

B. Maximum Variation from Plumb: 1/16 inch.

C. Maximum Variation from Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 TESTING AND ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust door, hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean door and components.

C. Remove labels and visible markings.

END OF SECTION

SECTION 08 34 73 - SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel sound-control doors, frames, seals, and certain hardware for special sound doors as scheduled.

B. Related Sections:
1. Section 08 71 00 – Door Hardware: For required hardware not provided under this section.
2. Section 09 90 00 – Painting and Staining: For field-applied paint finishes for steel doors and frames.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated. Include sound ratings, construction details, material descriptions, core descriptions, and finishes.

C. Shop Drawings: Include the following:
1. Elevations of each door design.
2. Details of sound-control seals, door bottoms, and thresholds.
3. Details of doors, including vertical and horizontal edge details and metal thicknesses.
4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Locations of reinforcement and preparations for hardware.
6. Details of each different wall opening condition.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.
10. Details of conduit and preparations for power, signal, and control systems.

D. Samples:
1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5-inches.
2. Retain both subparagraphs below if fabrication Samples are required.
3. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
4. Frames: Include profile, corner joint, floor and wall anchors, and seals. Include separate section showing fixed sound panels if applicable.

E. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

F. Product Certificates: For each type of sound-control door assembly, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of sound-control door assembly.

H. Warranty: Samples of special warranty.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.

B. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
   1. STC Rating(s): As indicated in the drawings, and as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in the section with minimum three years' experience.

B. Installer: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Acoustical Testing Agency: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished wood doors.

C. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.

D. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch high, wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
   1. If wrappers on doors become wet, remove cartons immediately. Provide a minimum of 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet sound rating requirements.
      b. Faulty operation of sound seals.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
   2. Warranty Period for Steel Doors: Five-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL SOUND-CONTROL DOOR ASSEMBLIES

A. Manufacturers:
   1. Assa Abloy, www.assaabloydooraccessories.us.com.
   2. Krieger Specialty Products Company, www.kriegerproducts.com
   3. Overly Door Company, www.overly.com
   4. Protective Door Industries, www.protectivedoor.com
   5. Wenger Corporation, www.wengercorp.com
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: *Acoustical Door and Frame* as manufactured by Wenger, or approved equivalent by specified manufacturer.

C. Description: Provide flush-design sound-control doors, minimum 1-3/4” thick or greater where required to meet specified STC rating, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC ratings indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to ANSI/NAAMM-HMMA 865.
   1. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 14-ga. outside face and 16-ga. inside face, or thicker as required to achieve STC rating indicated.
   2. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
   3. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6-inches o.c.
   4. Hardware Reinforcement: Same material as face sheets.

D. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control requirements.

2.2 SOUND-CONTROL FRAMES

A. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
   1. Weld frames according to NAAMM-HMMA 820.
   2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness, or thicker as required to provide STC rating indicated.
   3. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8-inch high, unless otherwise indicated.
   4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.
   5. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness, welded to head.

6. Jamb Anchors:
   a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2-inches wide by 10-inches long; or wire anchors not less than 0.156-inch thick.
   b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal thickness uncoated steel unless otherwise indicated.
   c. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
7. Floor Anchors: Not less than 0.079-inch nominal thickness metallic-coated steel, and as follows:
   a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

B. Materials:
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
3. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
4. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.
5. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

2.3 FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and scheduled field-applied coatings.

B. Final Finish: Field applied.

2.4 SOUND-CONTROL HARDWARE

A. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC rating indicated.
1. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
2. Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
3. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
   a. Mounting: Mortised or semi-mortised into bottom of door as required by testing to achieve STC rating indicated.
   b. Cam-Lift Hinges: Full-mortise template type that raises door 1/2-inch when door is fully open; with hardened pin; fabricated from stainless steel.

B. Other Hardware: Comply with requirements in Division 08 Section "Door Hardware".

2.5 SOUND-CONTROL ACCESSORIES

A. Glazing: Comply with requirements in Division 08 Section "Glazing."

B. Grout: Comply with ASTM C 476, with a slump of not more than 4-inches as measured according to ASTM C 143/C 143M.

C. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Sound-Control Steel Door Fabrication: Sound-control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
   1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
   2. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
      a. *Double pane glazing as with have combination of 1/4" and 3/8" thick panes.*
   3. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware".
      a. Reinforce doors to receive non-templated mortised and surface-mounted door hardware.
      b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
   4. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.

B. Sound-Control Frame Fabrication: Fabricate sound-control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
   1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18-inches from top and bottom of frame. Space anchors not more than 32-inches o.c. and as follows:
         1) Two anchors per jamb up to 60-inches in height.
         2) Three anchors per jamb from 60 to 90-inches in height.
         3) Four anchors per jamb from 90 to 96-inches in height.
      b. Stud Wall Type: Locate anchors not more than 18-inches from top and bottom of frame. Space anchors not more than 32-inches o.c. and as follows:
         1) Three anchors per jamb up to 60-inches in height.

2) Four anchors per jamb from 60 to 90-inches in height.
3) Five anchors per jamb from 90 to 96-inches in height.
4) Two anchors per head for frames more than 42-inches wide and mounted in metal stud partitions.

c. Post-installed Expansion Type: Locate anchors not more than 6-inches from top and bottom of frame. Space anchors not more than 26-inches o.c.

5. Head Reinforcement: For frames more than 48 inches wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
6. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware."
   a. Reinforce frames to receive non-templated mortised and surface-mounted door hardware.
   b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.
8. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sound-control door assemblies.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
   1. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16-inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Frames: Install sound-control door frames in sizes and profiles indicated.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Install sound-control frames with removable glazing stops located on secure side of opening.
      b. Remove temporary braces only after frames or bucks have been properly set and secured.
      c. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      d. Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar or grout.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.
      a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors, if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
   4. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   5. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
   6. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
      a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90-degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16-inch, measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.
   1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
      a. Jambs: 1/8-inch.
      b. Head with Butt Hinges: 1/8-inch.
      c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8-inch.
      d. Sill: Manufacturer's standard.
      e. Between Edges of Pairs of Doors: 1/8-inch.

D. Sound-Control Seals: Where seals have been prefit and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

F. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with sound-control door assembly manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9-inches o.c. and not more than 2-inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
   1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Clean grout off sound-control door frames immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

E. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 41 13 – ALUMINUM STOREFRONT AND ENTRANCE SYSTEMS

PART 1 - GENERAL

A. SUMMARY

A. Section includes:
1. Aluminum-framed storefronts, interior and exterior.
2. Aluminum entrance doors, interior and exterior.

B. Related Sections:
1. Section 07 90 00 - Joint Protection: Perimeter sealant at building interface.
2. Section 08 71 00 - Door Hardware.
3. Section 08 80 00 – Glazing.

B. REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 501 - Methods of Test for Exterior Walls.
2. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
4. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
5. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

C. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

C. SYSTEM DESCRIPTION

A. Aluminum-framed storefront system includes: tubular aluminum sections; aluminum and glass entrances; shop fabricated, factory finished, with glass and glazing specified in Section 08 80 00 and installed by this Section; related flashings, anchorage and attachment devices.

B. System Assembly: Site assembled.

D. PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
1. To design pressure indicated on Drawings, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to 1/175 for spans under 13’-6” and 1/240 plus 1/4 inch for spans over 13’-6”, with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with AAMA 501.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with glass.

F. Water Leakage: None, when measured in accordance with AAMA 501 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

G. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.69 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503.

H. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

I. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

E. SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface.

E. Design Data: Indicate framing member structural and physical characteristics and dimensional limitations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. QUALITY ASSURANCE

A. Perform Work in accordance with AAMA SFM-1 and AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Systems specified under this section and Section 08 44 13 Glazed Aluminum Curtain Walls shall be provided by the same manufacturer.

C. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years’ experience.

G. PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

H. DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.

C. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

I. ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants or glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

J. WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.
2. Warranty Period: Two years from date of Substantial Completion.

C. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

A. ALUMINUM-FRAMED GLAZING SYSTEMS

A. Manufacturers:
1. Arcadia Texas, www.arcadianc.com
2. Arch Aluminum & Glass Co., Inc. www.arch.amarlite.com
3. Columbia Commercial Building Products, www.ccbpwin.com
4. EFCO Corporation www.efcocorp.com
5. Kawneer www.kawneer.com
6. Tubelite Inc., www.tubeliteinc.com
7. United States Aluminum. www.usalum.com
8. Vistawall Architectural Products. www.vistawall.com/
9. YKK AP America Inc., www.ykkap.com.
10. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis-of Design:
1. Exterior Storefront Door and Window Frames: Kawneer *Trifab VG 601.*
2. Entrance Doors: Kawneer *Series 500 Tuffline Wide Stile*.
3. Interior Storefront Door and Window Frames: Kawneer *Trifab VersaGlaze* 450 or 451 as required for glass panel thickness.

C. Product Description:
1. Aluminum Frame: Thermally broken at exterior; flush glazing stops; center glazed to accommodate 1-inch thick glazing at exterior and ¼-inch thick glazing at interior.
a. Furnish closed backs at heads and jambs of exterior frames.
2. Profiles:
a. Exterior Frames: 2-inches wide x 6-inches deep.
b. Interior Frames: 1-3/4 inches wide x 4-1/2 inches deep.
c. Sill Frames: 2-inches high.
3. Doors: Aluminum Framed Glass Doors; 2-inches thick, nominal 8-inch wide top rail 5-

inch wide vertical stiles, minimum 10-inch wide bottom rail; 3/16” wall thickness; beveled glazing stops for 1” insulated glazing units.

B. COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.

E. Glass: Specified in Section 08 80 00.

F. Glazing Materials: Storefront manufacturer’s standard types to suit application and to achieve weather, moisture, and air infiltration requirements.

G. Flashings: Minimum 0.032-inch thick aluminum to match mullion sections where exposed.

H. Hardware: In accordance with Section 08 71 00 and as follows:
1. Weather Stripping: Manufacturer's standard replaceable components.
a. AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

I. Flashings: Minimum 0.032-inch thick aluminum to match mullion sections where exposed.

J. Sealant and Backing Materials:
1. Sealant Used Within System (Not Used for Glazing): Manufacturer’s standard materials to achieve weather, moisture, and air infiltration requirements.
2. Perimeter Sealant: Specified in Section 07 90 00.

K. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum brackets and reinforcements. Provide non-staining, nonferrous shims for aligning system components.

L. Fasteners: Manufacturer’s standard stainless steel, compatible with adjacent materials.

M. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

C. FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.

B. Fabricate sill pans with sealed end dams at jambs and changes in sill height.

C. Fabricate frames for glazing from inside.

D. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

E. Prepare components to receive anchor devices. Fabricate anchors.

F. Arrange fasteners and attachments to conceal from view.

G. Prepare components with internal reinforcement for door hardware.
1. At exterior door frames, provide weatherstripping at fixed stops.
2. At interior door frames, provide weatherstripping or silencers at stops to prevent door-to-frame contact.

H. Reinforce framing members for imposed loads.

D. SHOP FINISHING

A. Anodized Aluminum Surfaces for Framing: AAMA 611, AA-M12C22A44 non-specular as

fabricated mechanical finish, medium matte chemical finish, and Architectural Class I, 0.7 mils clear anodized coating. Class II coating allowable for interior systems only.

B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious materials or dissimilar metals.

D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

E. Extent of Finish:
1. Apply factory coating to surfaces exposed at completed assemblies.
2. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 - EXECUTION

A. EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION

A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Install sill pans. Turn up ends and edges; seal to adjacent Work to form water tight dam.

F. Coordinate attachment and seal of perimeter air and vapor retarder materials.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install integral flashings and integral joint sealers.

I. Set thresholds in sealant and secure.

J. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

K. Coordinate installation of glass and opaque panels with Section 08 80 00; separate panels from metal surfaces.

L. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10

ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust operating hardware and sash for smooth operation

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean

D. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

END OF SECTION

SECTION 08 51 13 – INTERIOR OPERABLE ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior horizontal sliding window(s) as indicated.

B. Related Sections:
   1. Section 08 80 00 – Glazing: General glazing requirements.

1.2 PERFORMANCE REQUIREMENTS

A. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of window required, including the following:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, accessories, and finishes.
   4. Recommendations for maintaining and cleaning exterior surfaces.

C. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
   1. Layout and installation details, including anchors.
   2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot scale.
   3. Full-size section details of typical composite members, including reinforcement and stiffeners.
   4. Panning details.
   5. Hardware, including operators.
   6. Glazing type and related details.
   7. Accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

C. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

1.5 PROJECT CONDITIONS

A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: 3-years after date of Substantial Completion.

C. Warranty Period for Metal Finishes and Glass: 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. All Seasons Commercial Division, www.allseasonswindows.com.
2. EFCO Corporation, www.efcocorp.com.
3. Graham Architectural Products Corporation, www.grahamarch.com.
4. Manko Window Systems, Inc., www.mankowindows.com.
5. Traco, www.traco.com.

B. Basis-of-Design:
1. Horizontal Sliding Windows: All Seasons, Series 700, HS-C30.

2.2 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.062 inch (1.6 mm) thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

E. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic,

nonshrinking, and nonmigrating. Comply with Division 7 Section "Joint Sealants" of these Specifications for selection and installation of sealants.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

B. Counterbalancing Mechanism: Comply with AAMA 902.2.
1. Sash-Balance Type: Concealed-spiral type of size and capacity to hold sash stationary at any open position.

C. Miscellaneous Hardware: Provide the following operating hardware:
1. Sash Rollers: Steel, lubricated ball-bearing rollers with nylon tires.
2. Lock: Cam-action sweep sash lock and keeper at meeting rails.

2.4 FACTORY GLAZING

A. Tempered Glass: Unless noted otherwise, provide ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering; conforming to CPSC 16 CFR 1201 Category II.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

B. Sound/Weatherstripping: Provide sliding-type weatherstripping for sound control where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.
1. Provide weatherstripping locked into extruded grooves in sash.

2.6 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
1. Provide units that are reglazable without dismantling sash or ventilator framing.
2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.

B. Preglazed Fabrication:
1. Preglaze window units with specified glass type(s) at the factory where possible and practical for applications indicated.
2. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

2.7 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: Non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I or Class II for interior, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill

plate is level.

1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

D. Refer to Division 7 Section "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

3.3 ADJUSTING

A. Adjust operating sash and hardware to provide a tight fit at contact points for smooth operation.

3.4 CLEANING

A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

B. Clean glass of pre-glazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glazing" for cleaning and maintenance.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Hardware for hollow steel and plastic laminate doors.

B. Thresholds.

C. Weather-stripping, seals and door gaskets.

1.2 RELATED SECTIONS

A. Section 08 11 00 – Metal Doors and Frames.

B. Section 08 14 00 –Wood Doors.

C. Section 08 33 00 – Coiling doors and Grilles.

D. Section 08 34 00 – Special Function Doors.

E. Section 08 40 00 – Entrances, Storefronts, and Curtain Walls.

1.3 REFERENCES

A. ADA – Americans with Disabilities Act, Accessibility Guidelines.

B. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

C. NFPA 80 – Fire Doors and Windows.

D. AWI – Architectural Woodwork Institute – Quality Standards.

E. NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures.

F. NFPA 252 – Fire Tests of Door Assemblies.

G. TAS – Texas Accessibility Standards.

H. UL 10B – Fire Tests of Door Assemblies.

I. UL 305 – Panic Hardware

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate locations and mounting heights of each type of hardware.

C. Submit manufacturer's parts lists and templates.

D. Manufacturers Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. All templates will be included with submittal documents to be turned over to door supplier.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 70 00.

B. Record actual locations of installed cylinders and their master key code.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01 70 00.

B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:

1. ADA.

2. ANSI A117.1.

3. NFPA 101.

4. NFPA 80.

5. NFPA 252.

6. TAS.

1.8 QUALIFICATIONS

A. Hardware Supplier Company specializing in supplying commercial door hardware with five years documented experience.

B. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.9 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements applicable to fire rated doors and frames.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

C. Deliver keys to Owner by security shipment direct from hardware supplier.

1.11 COORDINATION

A. Coordinate work under provisions of Section 01 03 90.

B. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

1.12 WARRANTY

A. Provide five year warranty under provisions of Section 01 70 00.

B. Warranty: Include coverage for door closers.

1.13 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Section 01 70 00.

B. Provide special wrenches and tools applicable to each different or special hardware component.

C. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 – PRODUCTS

2.1 HINGING METHODS:

A. Note: drawings typically depict doors at 90 degrees doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

B. Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.
2. Extra heavy weight hinges on doors over 3 feet, 5 inches in width.
3. Extra-heavy weight hinges on doors with panic hardware or fire exit devices.
4. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins.
5. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
6. Provide shims and shimming instructions for proper door adjustment.
7. All hinges to be ball bearing type on high use or doors with closers. Plain Bearing hinges are acceptable for any door that is not high traffic without a closer.
8. Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.

Acceptable Manufacturers: Ives, PBB, Hager

C. Continuous Hinges:

1. Pin and barrel stainless steel at all Exterior high traffic (HM) doors 700 Series.
2. Geared-type aluminum at all Exterior high traffic (Aluminum) doors 112XY series.
3. Geared-type aluminum at all Interior high traffic doors 112XY series.

Acceptable Manufacturers: Ives, Markar, Pemko

2.2 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Extra Heavy Duty Mortise Locks and Latches:

1. Chassis: cold-rolled steel. All functions must be available in one body. Case must be multi-function, minimum 10 functions in one case, able to be opened and worked on without voiding the warranty. Functions will be changed by changing the cam on the back of the cylinder. Latch must be all steel. Pot metal on the latch will not be accepted.
2. Latchbolts: 3/4 inch throw, 2 piece stainless steel anti-friction type.
3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
   a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
4. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
5. Deadbolts: stainless steel 1-inch throw.
6. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.

   a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
   b. ANSI/ASTM F476-84 Grade 31 UL Listed.

B. On renovations smaller than 20 doors, consult district lock shop

BASIS OF DESIGN: SCHLAGE L9000 17A SERIES (NO SUBSTITUTION)

2.3 KEYING REQUIREMENTS:

Key System: All cylinders will be keyed into the district's patented restricted existing small format interchangeable core key system. Cylinders must be compatible across small format interchangeable core and conventional format cylinders keyed to existing district A2 system. A vertical traveling pin will be used for a patent and placement shall be near the front of the cylinder for easy drilling of damaged cores. A restricted order verification system must currently in place to verify orders. A minimum of 5 keyways must be available in the system. Cores must be warrantied in any manufacturer's hardware. All keyways in the family must be able to be operated by one key. System must be patented until 2029. Key system must be UL437 capable. A preliminary key meeting will be held to establish guidelines for the system and a secondary key meeting will be held to review the proposed key system. Permanent cores shall be Contractor Furnished to be shipped directly to the district lock shop for owner installation. A construction key system will be in place during the construction period. Three control keys for the construction key system will be turned over to the district for installation of the permanent cores. Provided CKC Key Control all cores. Furnish (5) GMKS, (5) MKYS per set, (2) Change Keys per core. Bitting list must be provided in Excel spreadsheet format from the manufacturer to be directly input by file transfer into Sitemaster.

BASIS OF DESIGN: SCHLAGE EVEREST 29R (NO SUBSTITUTION)

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features:
1. Independent lab-tested 1,000,000 cycles**.** Must meet ANSI-156.3 – 2014.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated.
3. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function. Center case must be constructed of pressed steel, CAST STEEL ZINC DICHROMATED WILL NOT BE ACCEPTED. Four screws minimum will be required to fasten the center case.
4. Releasable in normal operation with 15-lb. maximum operating force, and with 32 lb. maximum pressure under 250-lb. load to the door.
5. Extruded aluminum grooved body.
6. Both solenoid and motorized electronic latch retraction must be available.

B. Specific features:

1. Supply rim devices with key removable mullion at all openings. *(Surface/Concealed vertical rods WILL NOT be accepted).*
2. Non-Fire Rated Devices: cylinder dogging.
3. Exit Device Trim: Stainless steel (Exterior/Interior) **vandal resistant trim** thru-bolted to device with plastisol coated grip. Night latch function retracts latch with use of key.
4. Fire-Labeled Devices: UL label indicating “Fire Exit Hardware”.
5. Delayed Egress Devices: Function achieved within single exit device component, including latch, delayed locking device, request-to-exit switch, nuisance alarm, remote alarm, key switch, indicator lamp, relay, internal horn, door position input, external inhibit input plus fire alarm input. NFPA 101 “Special Locking Arrangement” compliant.
6. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
7. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.

BASIS OF DESIGN: VON DUPRIN 99 (NO SUBSTITUTION)

2.5 CLOSERS

B. Surface Closers:

1. Full rack-and-pinion type cylinder with molded plastic cover and cast iron body. Pinion must be ¾”. Bearings must be full compliment. Arms must be forged steel. Minimum .625” bearing height required. Body must be powder coated, not spray lacquer. Size adjustment must be verified by visual aid on the end of the cylinder with a numeric dial. Snap on covers are to be standard.
2. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
3. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
4. Opening pressure: Exterior doors 8.5 lb., interior doors 5 lb., labeled fire doors 15 lb.
5. Separate adjusting valves for closing speed, latching speed and backcheck
6. Parallel Rigid arms (PR) at exterior doors scheduled with parallel arm units.
7. Exterior doors do not require seasonal adjustments in temperatures from 120 degrees F to –30 degrees F, furnish data on request.
8. Pressure Relief Valves (PRV): unsafe, not permitted.

9. Permanent metal templates must be available for installation.

BASIS OF DESIGN: LCN 4040XP SERIES (NO SUBSTITUTION)

2.6 OTHER HARDWARE

A. Automatic Flush Bolts: Low operating force design, “LBR” type where scheduled.

B. Surface Bolts: Shall be used at pairs of doors from non-fire rated Mechanical rooms for the inactive leaf.

C. Overhead Stops: Stainless steel (100 series). Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

D. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

E. Door Stops: Provide stops to protect walls, casework or other hardware.

1. Unless otherwise noted in Hardware Sets, provide wall type Ives WS406/WS407 series with appropriate fasteners (AND WOOD BLOCKING) provided. Where wall type cannot be used, provide floor type. (Ives FS18S exterior and FS436 Interior) If neither can be used, provide overhead type.
2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.

F. Seals: Finished to match adjacent frame color. Resilient seal material: polypropylene, nylon brush, or solid high-grade neoprene. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material’s thickness and durability. Proposed substitutions: submit for approval.

1. Solid neoprene: MIL Spec. R6855-CL III, Grade 40.
2. Non-corroding fasteners at in-swinging exterior doors.
3. Exterior pairs of mechanical room doors: Doors shall be equipped with appropriate seals, astragal, threshold, drip cap and sweeps to prevent the intrusion of rain water. Provide astragals at all interior pairs of doors to mechanical rooms.
4. Sound control openings: Use components tested as a system using nationally accepted standards by independent laboratories. Ensure that the door leafs have the necessary sealed-in-place STC ratings. Adhesive mounted components not acceptable. Fasten applied seals over bead of sealant.

5. Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements. Where rigid housed resilient seals are scheduled in this section and the selected door manufacturer only requires an adhesive-mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal plus the adhesive applied seal. Adhesive applied seals alone are deemed insufficient for this project where rigid housed seals are scheduled.Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, Intumescent seals vary in requirement by door type and door manufacture -- careful coordination required. Adhesive-applied Intumescent strips are not acceptable, use concealed-in-door-edge type or kerfed-in-frame type.
6. All exposed exterior doors not under a cover are to have a rain drip to extend four inches outside the width of the door.

G. Automatic door bottoms: low operating force units. Doors with automatic door bottoms plus head and jamb seals cannot require more than two pounds operating force to open when closer is disconnected.

H. Thresholds: As scheduled and per details. Substitute products: certify that the products equal or exceed specified material’s thickness. Proposed substitutions: submit for approval.

1. Exteriors: Seal perimeter to exclude water and vermin. Use butyl-rubber or polyisobutylene sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).
2. Acoustic openings: Set units in full bed of Division-7-compliant butyl-rubber or polyisobutylene sealant, leave no air space between threshold and substrate.
3. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.

I. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

J. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.

K. Wall- & Floor-mounted electromagnetic door holders: LCN's SEM series or approved equivalent. Incorporate into U.L.-listed fire & life-safety system, doors release to allow closure and latching when door's zone is in alarm state. Use minimum projection required to allow door to open as widely as allowed by wall conditions and projection of door hardware.

BASIS OF DESIGN: IVES, SUBSTITUTIONS INCLUDE BUT ARE NOT LIMITED TO TRIMCO, HAGER, ROCKWOOD, AND OTHER PRODUCTS MEETING THIS STANDARD.

2.7 FINISH:

A. Generally BHMA 626 Satin Chromium
1. Areas using BHMA 626 to have push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

C. Aluminum items: match predominant adjacent material. Seals to coordinate with frame color.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

B. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.

C. Verify that electric power is available to power operated devices and of the correct characteristics.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use templates and fasteners provided by hardware item manufacturer.

C. Use sex bolts to attach panic devices to wood doors and all closers.

D. Hardware installer shall be an entity that specializes in hardware installation and must have a minimum of ten years experience and provide five reference jobs of similar scope. Submit references with hardware submittals/shop drawings.

E. Hardware installer is required to send all personnel that will install on this job shall attend a pre-installation meeting with the manufacturer's representative to review the install instructions.

F. Contractor will install permanent cores and turn all keys over to the district.

3.3 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

A. Adjust work under provisions of Section 01700.

B. Adjust hardware for smooth operation.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Do not permit adjacent work to damage hardware or finish.

3.6 HARDWARE SETS

114800 OPT0378980 Version 3
Hardware Group No. 001 - OH DOOR

For use on Door #(s):
PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R QTY REQD	626	SCH
1	EA	SFIC MORT CYLINDER	80-132 W/KEYED CONST. CORE QTY/TYPE REQD	626	SCH
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 103 - SGL OFFICE

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050HD 17A L583-363	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 201 - SGL STORAGE CLOSER

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080HD 17A	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203 - SGL STORAGE

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080HD 17A	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 214 - PAIR STORAGE EXTERIOR

For use on Door #(s):
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	STOREROOM LOCK	L9080HD 17A	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	COORDINATOR	3780	BLK	ABH
2	EA	SURFACE CLOSER	4040XP-SHCUSH-SNB	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT	AA	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-FRAME WIDTH (OR AS DETAILED)	A	ZER

Hardware Group No. 341 - TYPICAL SGL PRIVATE TOILET - PRIVACY/INDICATOR

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/COIN TURN W/ OUTSIDE INDICATOR	L9044 17A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	JAMB SEAL	870AA-S (2PCS JAMB HEIGHT)	AA	ZER
1	EA	DOOR BOTTOM	369AA/355AA-Z49 (WD/MD AS REQ)	AA	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 553 - SGL STORAGE LOCK (CLASSROOM)

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	L9071HD 17A	626	SCH
2	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 711 - SGL EXIT DEV VANDAL TRIM

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	PANIC HARDWARE	CD-99-EO-SNB	626	VON
2	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	SFIC MORT CYLINDER	80-132 W/KEYED CONST. CORE	626	SCH
1	EA	SFIC RIM CYLINDER	80-159 W/KEYED CONST. CORE	626	SCH
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 714M - PAIR EXIT DEV EXTERIOR (HM)

For use on Door #(s):
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	700-HEIGHT REQD	630	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
2	EA	PANIC HARDWARE	CD-99-EO-SNB	626	VON
4	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
3	EA	SFIC MORT CYLINDER	80-132 W/KEYED CONST. CORE	626	SCH
1	EA	SFIC RIM CYLINDER	80-159 W/KEYED CONST. CORE	626	SCH
1	EA	DOOR PULL	VR910 DT SNB	630	IVE
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
2	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-FRAME WIDTH (OR AS DETAILED)	A	ZER
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. 801L - PUSH/PULL/ DEADLOCK (PUBLIC RESTROOM)

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM DEAD LOCK	L463HD	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8303 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. C205 - SGL LOCK EXTERIOR - ACCESS CONTROLLED

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP SIZE REQD	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU MORTISE LOCK	L9092HDEU 17A CON 12/24 VDC	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-FRAME WIDTH (OR AS DETAILED)	A	ZER
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C714M - PAIR EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED

For use on Door #(s):
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	700-HEIGHT REQD	630	IVE
1	EA	CONT. HINGE	700 EPT-HEIGHT REQD	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	CD-99-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-EO-CON-SNB 24 VDC	626	VON
3	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
2	EA	SFIC MORT CYLINDER	80-132 W/KEYED CONST. CORE	626	SCH
1	EA	SFIC RIM CYLINDER	80-159 W/KEYED CONST. CORE	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-FRAME WIDTH (OR AS DETAILED)	A	ZER
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C715 - SGL EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	700 EPT-HEIGHT REQD	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-EO-CON-SNB 24 VDC	626	VON
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	SFIC RIM CYLINDER	80-159 W/KEYED CONST. CORE	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-FRAME WIDTH (OR AS DETAILED)	A	ZER
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. S503 - S=STC DOOR - BASIS OF DESIGN HARDWARE SET FOR OTHER MFR I.E.. KREIGER OR OVERLY

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EA	HINGE/PIVOTS	PROVIDED BY SOUND DOOR MFG		B/O
1	EA	CLASSROOM LOCK	L9070HD 17A	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
	EA	BALANCE OF HARDWARE	PROVIDED BY SOUND DOOR MFG		B/O
1	EA	STRIKE & CLOSER MOUNTING BRACKETS	328SPB/870SPB/770SPB (AS REQD)		ZER

BASIS OF DESIGN HARDWARE SET
-ALL HARDWARE SPECIFIED MUST BE APPROVED/COORDINATED WITH THE STC DOOR MFR. PRIOR TO ORDERING DOORS, FRAMES AND HARDWARE.
-A STANDARD STC UNIT IS SUPPLIED WITH NECESSARY HINGES, PERIMETER GASKETING AND RETAINER, DOOR BOTTOM, LOOSE STOPS, STOP OFFSET HARDWARE BRACKETS AND ALL REQUIRED FASTENERS.
-CLOSERS WITH EDA OR CUSH (RIGID TYPE ARMS) NOT ALLOWED WITH CAM-LIFT HINGES.

Hardware Group No. S701 - S=STC DOOR - BASIS OF DESIGN HARDWARE SET FOR OTHER MFR I.E.. KREIGER OR OVERLY

For use on Door #(s):
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EA	HINGE/PIVOTS	PROVIDED BY SOUND DOOR MFG		B/O
1	EA	PANIC HARDWARE	99-L-17-SNB	626	VON
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	SFIC RIM CYLINDER	80-159 W/KEYED CONST. CORE	626	SCH
1	EA	SURFACE CLOSER	4040XP-TBSRT-MOUNTING/ARM/BRKT A REQD	689	LCN
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
	EA	BALANCE OF HARDWARE	PROVIDED BY SOUND DOOR MFG		B/O
	EA	STRIKE & CLOSER MOUNTING BRACKETS	328SPB/870SPB/770SPB (AS REQD)		ZER

BASIS OF DESIGN HARDWARE SET
-ALL HARDWARE SPECIFIED MUST BE APPROVED/COORDINATED WITH THE STC DOOR MFR. PRIOR TO ORDERING DOORS, FRAMES AND HARDWARE.
-A STANDARD STC UNIT IS SUPPLIED WITH NECESSARY HINGES, PERIMETER GASKETING AND RETAINER, DOOR BOTTOM, LOOSE STOPS, STOP OFFSET HARDWARE BRACKETS AND ALL REQUIRED FASTENERS.
-CLOSERS WITH EDA OR CUSH (RIGID TYPE ARMS) NOT ALLOWED WITH CAM-LIFT HINGES.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes glass and glazing for the following:
   1. Aluminum storefronts and entry systems, including fixed windows.
   2. Door lights for interior wood or steel doors.
   3. Interior fixed windows for steel and/or aluminum frames.
   4. Fire-resistant glazing where indicated.
   5. Other miscellaneous glass products including but not necessarily limited to unframed mirrors.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection: Requirements for sealant and back-up material other than glazing sealants.
   2. Section 08 11 13 - Standard Steel Doors and Frames: Glazing in steel doors, sidelights, and windows.
   3. Section 08 14 16 - Flush Wood Doors: Glazing in door-lite frames.
   4. Section 08 41 13 - Aluminum Storefront and Entrance Systems.
   5. Section 08 83 00 – Unframed Mirrors.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
   1. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   2. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM E1300 – Standard Practice for Determining Load Resistance of Glass in Buildings.
   5. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

E. Flat Glass Marketing Association:
   1. FGMA Glazing Manual: Glazing compounds and preformed glazing sealants.

F. Glass Association of North America:
   1. GANA - Sealant Manual.
   2. GANA - Glazing Manual.
   3. GANA - Laminated Glass Design Guide.

1.3 PERFORMANCE REQUIREMENTS

A. Glass Thickness: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses conforming to ASTM E1300 and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Wind Loads: As indicated, but not less than wind loads required by ASCE 7 "Minimum

Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."

2. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   a. Load Duration: 3 seconds.
3. Maximum Lateral Deflection: For exterior glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
4. Minimum Glass Thickness for Exterior Lites: Not less than 1/4 inch per each pane of 1” insulated glazing panel.

B. Thermal Movements: Provide glazing that allows for noiseless thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
   1. U-Values: NFRC 100.
   2. Solar Heat Gain Coefficients: NFRC 200.
   3. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Glass: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, and special handling or installation requirements.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
   3. Glass Film: Provide product data and installation instructions on applied glass film.

C. Samples:
   1. Glass: Submit two samples 12x12 inch in size, of each type and color of glass specified, including frosted glass.
   2. Glazing Materials: Submit 12-inch long bead of glazing sealant for each color other than black.
   3. Glass Film: Submit two samples of clear glass, 12 x 12 inch in size, with sample graphics film applied.

D. Manufacturer's Certificate: Certify sealed insulating glass and low-E coated glass meet or exceed specified requirements.

E. Installer's Certificate: Certify glass furnished without identification label is installed in accordance with Construction Documents and applicable code.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
   1. Obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units are specified for lites more than 9 sq. ft. in exposed surface area, and lites of any size in certain hazardous locations such as sliding glass doors, doors and enclosures for bathtubs, showers, hot tubs, whirlpools, saunas, and steam rooms, provide glazing products that comply with Category II materials; for lites 9 sq. ft. or less in exposed surface area, provide glazing products that comply with Category I or II materials.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

C. Do not proceed with glazing operations when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation of graphics film with installation of glass and glazing gaskets to ensure that edges of film are covered by gaskets in final installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Extended Warranties:
1. Furnish 4-year warranty to include coverage for laminated glass units from deterioration or failure, and replacement of same.
2. Furnish 5-year warranty to include coverage for coated glass units from coating deterioration or failure, and replacement of same.
3. Furnish 10-year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Rated Glazing
1. Guardian Glass, www.guardianglass.com
2. Oldcastle Building Envelope www.oldcastlebe.com
3. Pilkington North America, Inc. www.pilkington.com
4. U.S. Bullet Proofing, www.usbulletproofing.com
5. Viracon www.viracon.com
6. Vitro Architectural Glass (PPG) www.ppg.com
7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering; furnish tempered glass conforming to CPSC 16 CFR 1201 Category II.

B. Low-E Coating: ASTM C1376, vacuum deposited, Low-Emissivity coating for all exterior insulated glazing units.

C. Fabricated Exterior Insulating Glass Panels: ASTM E2190 certified by Insulating Glass Certification Council (IGCC) with fully tempered Class 1 and 2 glass lites separated by a dehydrated airspace that is hermetically dual sealed with a primary seal of polyisobutylene (PIB), or thermo plastic spacer (TPS) and a secondary seal of silicone or an organic sealant as determined by the manufacturer for the specific application.

1. Basis of Design: Fully tempered clear with *Sunguard* Low-E coating as manufactured by Guardian Glass or approved equivalent by specified manufacturer.
2. Edge Condition:
   a. Black edge seal.
   b. At typical exterior glazing fabricate for typical aluminum framing conditions with resilient glazing gaskets.
3. Performance, Low-E Insulating Glass Units – Fabricated panels shall provide the following tested values or better:
   a. Visible Light Transmission: 62%.
   b. Reflectance: 11% outdoor visible light reflectance.
   c. U-Value: Winter nighttime 0.29.
   d. Shading Coefficient: 0.31
   e. Solar Heat Gain Coefficient: 0.27

2.3 SCHEDULED GLAZING TYPES – As indicated in the drawings.

A. **Type GL- :** Dual-pane clear glazing units for all exterior ground floor glazing, ASTM E2190 certified by Insulating Glass Certification Council; with aluminum and silicone edge seal; black edge seal color; purge interpane core space with dry hermetic air.
1. Basis of Design: Insulated system manufactured by U.S. Bulletproofing or approved equivalent by a specified manufacturer.
2. Total Unit Thickness: 1-1/16”, including nominal 1/2" dry air core.
3. Outer Pane: Clear tempered glass 1/4" thickness with specified low-E coating applied to number 2 surface.
4. Inner Pane: Clear laminated glass consisting of 2-plies of 1/4” annealed clear glass bonded together with 0.080 PVB clear interlayer. Pane thickness nominal 9/16".
5. Installed system shall meet TEA requirements and UL 972 for Delayed Forced Entry.

B. **TYPE GL-** : Typical Single-pane interior non-rated glazing; ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, clear float glass with horizontal tempering; furnish tempered glass conforming to CPSC 16 CFR 1201 Category II.
1. Thickness: 1/4-inch thick unless indicated otherwise.
2. Locations: Use for all interior glazing except Security Glazing.

C. **Type GL- :** Single-pane laminated glass at interior storefront systems, fixed windows, and door lights at security vestibules.
1. Basis of Design: Insulated system manufactured by U.S. Bulletproofing or approved equivalent by a specified manufacturer.
2. Fabrication: 1/4” clear annealed glass + 0.09” PVB interlayer + 1/4” clear annealed glass.
3. Total Thickness: Nominal 9/16 inch.
4. Plastic Interlayer: Clear polyvinyl butyral.
5. Installed system shall meet TEA requirements and UL 972 for Delayed Forced Entry.

2.4 GLAZING ACCESSORIES

A. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; black color.
1. Neoprene: ASTM C864.
2. EPDM: ASTM C864.
3. Silicone: ASTM C1115.

B. Soft Gaskets: ASTM C509 Type II; resilient extruded shape to suit glazing channel retaining slot; black color.

1. Neoprene.
2. EPDM.
3. Silicone.

C. Pre-Formed Glazing Tape: Size to suit application.
1. Preformed butyl compound with or without integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
c. Basis of Design: DAP #1202.

D. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4-inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

E. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3-inch long x one half the height of glazing stop x thickness to suit application, self-adhesive on one face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for glazing are correctly sized and within acceptable tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
1. Glazing Sealants: Comply with ASTM C1193.
2. Do not allow metal-to-glass contact.

B. Exterior Dry Method (Gasket Glazing):
1. Cut glazing gasket to length; install on glazing pane. Seal corners by butting tape and sealing junctions with compatible butyl sealant.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
3. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
4. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

C. Interior Dry Method (Tape and Tape) Installation:
1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners. Provide additional setting blocks where recommended by the glazing panel manufacturer.

3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
4. Place glazing tape on free perimeter of glazing in same manner described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Knife trim protruding tape.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove glazing materials from finish surfaces.

C. Remove labels after Work is complete.

D. Clean glass and adjacent surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 83 00 – UNFRAMED MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass mirrors for frameless installation.

B. Related Sections:
1. Section 06 20 24 - Interior Finish Carpentry and Millwork: Oak trim support for mirrors.
2. Section 08 80 00 - Glazing: Glass and glazing.
3. Section 10 28 00 - Toilet and Bath Accessories: Metal framed mirrors.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. ASTM International:
1. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C. Consumer Product Safety Commission:
1. CPSC 16 CFR 1201; Safety Standard for Architectural Glazing.

D. Glass Association of North America:
1. GANA - Glazing Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
2. Glazing Materials: Submit chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Manufacturer's Certificate: Certify mirrors meet or exceed specified requirements.

D. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for mirror installation methods.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1.5 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year warranty to include coverage for reflective coating on mirrors and replacement of same.

PART 2 - PRODUCTS

2.1 MIRRORS

A. Tempered Safety Mirror Glass: ASTM C1048, Kind FT fully tempered, Type 1 transparent

flat, Class 1 clear, Quality q1 mirror select; type with copper and silver coating, and organic overcoating.
1. Edges: Polished.
2. Thickness: 1/4 inch.
3. Size: As noted on Drawings.

2.2 ACCESSORIES

A. Mirror Attachment Accessories: Extruded aluminum J-profile channels with concealed fasteners.

B. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.

C. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

D. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.
1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.3 FABRICATION

A. Cut mirrored glass to final sizes and shapes to suit Project conditions.

B. Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.

C. Seal edges of silvered mirrored glass after edge polishing to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify wall surfaces are clean, free of obstructions, and ready to receive mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
1. Set mirrors plumb and level, free of optical distortion.
2. Set mirrors with edge clearance free of surrounding construction including counter tops and backsplashes.
3. Provide space for air circulation between back of mirrored glass units and face of mounting surface.

B. Frameless Mechanical Installation:
1. Set mirrors with J-profile channels, with Oak trim support. Anchor rigidly to wall construction.
2. Gap vertical joints uniformly 3/16” and fill neatly with clear silicone sealant.
3. Place plumb and level without visible distort.
4. For continuous bottom supports, provide setting blocks 1/8 inch thick by 4 inches long at quarter points. For channels or other continuous supports in which water could be trapped, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long.

C. Frameless Adhesive Installation:
1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.

2. Set mirrors with adhesive.
3. Place plumb and level without visible distortion.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect for quality of glazing.

C. Do not permit edges of silvered mirrored glass to be exposed to standing water.

D. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove labels after Work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 08 91 00 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fixed louvers, frames and accessories.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection: Sealant at louver perimeter.
   2. Section 07 42 13 – Metal Wall Panels.

1.2 REFERENCES

A. ASTM International:
   1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 PERFORMANCE REQUIREMENTS

A. As follows, determined by testing units 48 inches wide by 48 inches high per AMCA Standard 500:
   1. Louver Free Area: Nominal 50% or not less than 7.81 sq. ft.
   2. Static Pressure Loss: Not more than 0.14 inch water gage at an airflow of 810 fpm free area intake velocity.
   3. Water Penetration: Not more than 0.02 oz. per sq. ft. of free area at an airflow of 855 fpm free area velocity when tested for 15 minutes.

B. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blank-out areas required, and frames.

C. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

D. Samples: Submit two samples illustrating finish and color of exterior surfaces.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of metal siding and masonry flashings.

C. Coordinate Work with installation of mechanical ductwork.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish twenty year manufacturer warranty for louvers.

C. Warranty: Include coverage for degradation of fluoropolymer finish.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Manufacturers:
1. Airline Products Co.
2. Airolite Co. www.airolite.com
3. Airstream Products www.pennvent.com
4. Construction Specialties, Inc. www.c-sgroup.com
5. Reliable Metal Products. www.reliablelouvers.com
6. Ruskin Mfg. www.ruskin.com
7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B209, alloy 3003 or 5005, temper as required to produce required finish.

B. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

C. Flashings: Of same material and finish as louver frame.

D. Sealants: As specified in Section 07 90 00.

2.3 COMPONENTS

A. Wall Louvers - Non-Drainable Style
1. Louver Construction: Aluminum.
2. Louver Depth: 4 inches, unless otherwise indicated.
3. Frame Type: Channel flange.
4. Frame Thickness: 0.081 inch.
5. Louver Blade Thickness: 0.081 inch.
6. Louver Blade Profile: Plain blade with no center baffle.
7. Louver Blade Angle: 37 1/2 degrees.
8. Louver Blade Spacing: 3".

2.4 ACCESSORIES

A. Bird Screen: Interwoven 1/4 inch mesh of 0.063 inch diameter aluminum wire.

B. Fasteners and Anchors: Stainless steel type.

C. Blank-Out Sheeting on Interior of Louver: Same material and finish as louver and frame:
1. Configuration: Single sheet.

2.5 FABRICATION

A. Louver Frame: Mechanically fastened corner joints. Form perimeter of frames with recessed channel to retain backer rod for sealant application.

B. Intermediate Mullions: Concealed, of extruded aluminum, profiled to suit louver frame.

1. Space at 72 inches o.c. or as recommended by manufacturer.

C. Sill Extensions: Provide sill extensions and loose sills made of same material as louvers where required for drainage to exterior.

D. Screens: Install screen mesh in channel-shaped frame; reinforce corner construction.

2.6 FACTORY FINISHING

A. Aluminum - Painted Finish: Manufacturer's 2 coat fluoropolymer finish with minimum 50 percent polyvinylidene fluoride resin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install louvers level and plumb.

B. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

C. Secure louvers in opening framing with concealed fasteners.

D. Install bird screen and frame to interior of louver. Attach to frame with stainless steel machine screws.

E. Attach blank-off sheet to back of frame with stainless steel sheet metal screws.

F. Install perimeter sealant and backing rod in accordance with Section 07 90 00.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements - Final cleaning.

B. Strip protective finish coverings.

C. Clean surfaces and components.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Metal stud interior wall framing.
2. Metal channel ceiling/soffit framing.
3. Gypsum board installation and joint treatment.
4. Cement-fiber tiling backer board and related membrane.
5. Acoustic insulation and sealant.
6. Glass mat gypsum sheathing board.
7. Preformed aluminum reveals.

B. Related Sections:
1. Section 05 40 00 - Cold-Formed Metal Framing-support framing for gypsum sheathing and air barrier.
2. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking attached to metal stud framing.
3. Section 07 27 26 – Fluid-Applied Membrane Air Barrier.
4. Section 08 31 13 - Access Doors and Frames: Metal access panels.
5. Section 09 90 00 – Painting and Coating: Priming and painting as scheduled for gypsum board.
6. Section 10 28 10 – Miscellaneous Specialties: Corner molding.

1.2 REFERENCES

A. ASTM International:
1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
4. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
6. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
7. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
8. ASTM C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
9. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
10. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
13. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 - Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

D. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal framing, gypsum board, cementitious backer board, glass mat sheathing, joint materials, acoustic insulation and sealant, and fasteners.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840.

B. Fire Rated Wall and Ceiling Construction: Rating as indicated on Drawings, tested in accordance with ASTM E119.
1. Fire Rated Ceilings and Partitions: Listed assembly by UL, WH, or GA.
2. Fire Rated Shaft Wall Requirements: Listed assembly by UL, WH, or GA.

C. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Manufacturers:
1. ClarkDietrich Building Systems, www.clarkdietrich.com.
2. General Rolling Mills., www.generalrollingmills.com.
3. Marino\Ware, www.marinoware.com.
4. Phillips Manufacturing, www.phillipsmfg.com.
5. USG Corporation, www.usg.com.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Studs: ASTM C645, galvanized sheet steel, C shape, 25 gage thick, depth as indicated.
1. Furnish 20 gage studs at the following locations:
a. Studs framing doors.
b. Walls finished with tile.
c. Walls finished with abuse resistant gypsum board.
d. Studs supporting wall-mounted accessories and TV brackets.
2. Section Modulus Requirements
a. 3-5/8" Studs: S = 0.135
b. 2-1/2" Studs: S = 0.082

C. Standard Tracks: ASTM C645, galvanized sheet steel, depth and thickness to match studs.

D. Deflection Tracks:
1. Non-Rated Walls: ASTM C645-8, with 2-inch deep flanges, gauge to match studs.
2. Rated Walls:
a. Combination deflection track and fire stop system consisting of mineral fiber, fire caulk, zee clips and accessories as required to achieve the design rating.
b. Basis of Design: *Shadowline* as manufactured by Firetrack Corp.
3. Installed deflection tracks shall allow 3/4" or more of vertical movement up or vertical movement down.

E. Grid Suspension System for Interior Ceilings: ASTM C645, direct-hung system composed of

galvanized cold-formed main beams and interlocking cross-furring members.
1. Manufacturers:
   a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
   b. USG Interiors, Inc.; Drywall Suspension System.

F. Furring, Framing, and Accessories: ASTM C645.

G. Fasteners: ASTM C1002; Type S; length to suit application.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

I. Suspension Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch diameter wire, or double strand of 0.0475 inch diameter wire.

2.2 GYPSUM BOARD MATERIALS

A. Manufacturers:
1. American Gypsum Co., www.americangypsum.com.
2. CertainTeed Corp., www.certainteed.com
3. Georgia-Pacific Gypsum, www.gp.com
4. National Gypsum Company, www.nationalgypsum.com
5. Temple-Inland Inc., www.templeinland.com
6. USG Corporation www.usg.com
7. Substitutions: Section 01 25 00 – Substitution Procedures.

B. General: All specified types shall meet the following requirements unless otherwise noted:
1. Conform to ASTM C1396 section 5 (C 36) and Federal Specification SS-L-30D Type lll, Grade X fire- resistant.
2. Ends square cut, tapered long edges wrapped.
3. 5/8” gypsum core faced and edge-wrapped with mold and moisture resistant 100% recycled paper.
4. Surface Burning Characteristics per ASTM E 84:
   a. Flame Spread = 0
   b. Smoke Developed = 0.
5. Intended for interior applications only.

C. Typical Gypsum Board Panels:
1. Basis of Design: FireBloc® Type X as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. Use throughout the interior of the Project except for specialized uses and locations requiring other panel types as indicated below.

D. Moisture-Resistant Gypsum Board:
1. Basis of Design: AquaBloc® Type X as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. 5/8” water-resistant gypsum core faced with mold and moisture resistant 100% recycled green-color paper
3. Water Absorption: Less than 5% per ASTM 1396.
4. Meet requirements of Federal Specification SS-L-30D Type Vll, Grade X.
5. Use at restrooms, shower rooms, custodial rooms and other areas subject to high moisture. Where board is not surfaced with tile, prepare for finish painting.
   a. Behind wall tile.
   b. Toilet room walls not receiving cementitious backer board.

E. Abuse-Resistant Gypsum Board: Not required.

F. Impact-Resistant Gypsum Board: Not required.

G. Fire Rated Assemblies: Not required.

2.3 CEMENTITIOUS BACKER BOARD

A. Manufacturers:
1. Custom Building Products; Wonderboard Cement Backerboard.
2. FinPan, Inc.; Util-A-Crete Concrete Backer Board.

3. National Gypsum Company; PermaBase Cement Board.
4. USG Company; DUROCK Cement Board.
5. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Cementitious Backer Board: ASTM C1325; High density, glass fiber reinforced, ½-inch thick; 24-inch wide, coated glass fiber tape for joints and corners.
1. Provide at: All shower walls, and all wet walls behind lavatories, toilets, and urinals, as well as the side walls adjacent to these fixtures.
2. Membrane: Per TCA W244 install waterproof membrane directly behind cementitious backer board, overlapping joints 4”-6”:
a. #15 asphalt saturated felt meeting requirements of ASTM D226, Type 1.
b. Minimum 6 mil polyethylene film meeting requirements of ASTM D4397.

2.4 GLASS MAT GYPSUM SHEATHING BOARD

A. Manufacturers:
1. GlasRoc; BPB America Inc., www.glasroc.com.
2. Dens-Glass Gold, Georgia-Pacific Gypsum, www.gp.com.
3. GreenGlass, Temple-Inland, Inc., www.templeinland.com.
4. Securock, USG Corporation, www.usg.com.
5. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, paperless, with glass mat facing on, or embedded into, each side of a water-resistant gypsum core; 48 x 96 inch size, 1/2-inch thick.
1. Flame Spread Rating: 0.0.
2. Smoke Developed: 0.0.

C. Fasteners: ASTM C954; steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.5 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness to match studs.
1. If required by fire-resistance requirements for fire rated walls, furnish mineral fiber insulation complying with ASTM C665, Type I.

B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Gypsum Board Accessories: ASTM C1047; galvanized steel, aluminum coated steel, or rolled zinc; corner beads, edge trim, and expansion joints.
1. Furnish Type LC bead at exposed panel edges.
2. Furnish rolled zinc material at exterior locations.

D. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

E. Joint Materials: ASTM C475; reinforcing tape, joint compound, and water.

F. Gypsum Board Screws: ASTM C1002, Type S; length to suit application.
1. Use screws complying with ASTM C954 for fastening panels to cold formed metal framing specified in Section 05 40 00.
2. Use screws recommended by manufacturer for fastening cementitious backer board to metal framing.

G. Knee-Wall Bracing
1. 2” x 2” x 1/8” wall steel tube fully-welded to 3-1/2” x 5” deep x 1/4” thick steel base plate with (4) pre-punched mounting holes.
2. Product: *SKB Knee Brace Kit* as manufactured by Softforms, www.kneewall.com, or approved equivalent.
3. Fasteners: 3/8” x 3-1/2” long expansion bolts as recommended by the manufacturer. Use (4) bolts per mounting plate.
4. Height: Fabricate or job-cut height of brace tube to be no lower than 2” below knee-wall height.

5. Spacing: Install braces at 48” maximum within low stud walls and fasten one metal stud on each side of brace using self-tapping screws at nominal 6” centers vertically.

H. End-Wall Trim
1. Where indicated provide prefinished aluminum end-wall trim at walls terminating on window mullions.
2. Type: Cased Jamb as manufactured by Raco Interior or approved equivalent.
3. Finish: Anodized to match window system mullions.

I. Aluminum Reveal Molding
1. Type: 6063 T5 alloy extruded aluminum open reveal.
2. Size(s): 5/8” deep x continuous x widths as indicated in the drawings.
3. Finish: Clear anodized aluminum.
4. Fabricate with wings and edge beads for taping and floating.
5. Mill finish or clear anodized.
6. Locate as indicated in the drawings over continuous drywall framing support.
7. Basis of Design: “F” reveal as manufactured by Fry Reglet Corp. or approved equivalent by Schluter.

2.6 GYPSUM BOARD SHAFT WALLS: Not required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on drawings.

C. Ensure that all exterior air-barrier work and roofing is completed, roof-top equipment fully installed and flashed, exterior wall openings including windows and doors are installed, and building is environmentally controlled prior to beginning any gypsum wallboard or ceiling board installation.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Suspend overhead framing from structural members or floor slabs only; do not suspend members from steel roof decks.

3.3 INSTALLATION

A. Metal Stud Installation:
1. Install studs in accordance with ASTM C754.
2. Metal Stud Spacing:
a. Typical Spacing: 16 inches on center maximum.
b. Walls to Receive Tile: Increase stud gauge to 20ga. and install studs 12-inches on center behind wall tile and elsewhere where indicated.
3. Fasten stud ends to floor and ceiling tracks (except at deflection tracks). Do not rely solely on gypsum board panels for stud-to-track connections.
4. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Install deflection track at tops of walls to avoid axial loading.
5. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
6. Do not bridge building expansion joints with framing or furring members. Frame both sides of joints independently.
7. Door Opening Framing: Install double studs at door frame jambs.
8. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets,

toilet accessories, and other wall-mounted items.

9. Where studs are installed directly against exterior walls, install asphalt-saturated felt isolation strip between studs and wall.

B. Curved Partitions:
   1. Frame curved partitions to comply with GA-226 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated.
   2. Cut top and bottom tracks through leg and web at 2-inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
   3. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   4. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.
   5. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

C. Suspended Framing Installation:
   1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
   2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
   3. Suspend hangers from building structure as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      b. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
      c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   4. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   6. Do not attach hangers or suspend members from steel roof deck.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
   9. Laterally brace entire suspension system.
   10. Grid Suspension Systems:
      a. Install grid suspension system in accordance with manufacturer’s instructions
      b. Attach perimeter edge angle where ceiling system meets vertical surfaces
      c. Mechanically join main beam and cross furring members to each other and butt-cut to fit into wall track.

D. Exterior Soffit Framing Installation:
   1. Install in accordance with ASTM C754.
   2. Coordinate location of hangers with other work.
   3. Install soffit framing independent of walls, columns, and above soffit work.
   4. Reinforce openings in suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
   5. Do not attach hangers to steel deck tabs.
   6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
   8. Brace system to resist lateral loads and wind uplift. Provide cross-bracing and additional framing required to resist wind uplift for design loads of 20 psf inward and outward.

E. Interior Ceiling Framing Installation:
   1. Install grid suspension system in accordance with manufacturer’s instructions.

2. Laterally brace entire suspension system to building structure.
3. Install acoustic sealant between tops of partitions and bottom of ceiling board.

F. Gypsum Board Installation:
1. Install gypsum board in accordance with ASTM C840.
2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   a. Use maximum practical lengths to eliminate end joints. Fit ends and edges closely together. Stagger joints between panels to avoid 4-way joint intersections.
   b. Lift and maintain bottom of panels 1/2" above finish floor level prior to fastening.
   c. For single-layer vertical application of gypsum panels, space screws 12" o.c. maximum in field of panels and 8" o.c. staggered along vertical abutting edges. For horizontal panel application, space screws 12" o.c. maximum in field and along abutting end joints.
   d. For ceiling and soffit panel application, space screws 12" o.c. maximum in field and 8” o.c. maximum along abutting end joints.
   e. At fire-rated partitions, erect single layer gypsum board vertically, with edges and ends occurring over firm bearing.
3. Double Layer Applications: Place second layer parallel with first layer. Offset joints of second layer from joints of first layer. Stagger joints on opposite sides of partition.
4. Cover both faces of stud framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
5. Erect ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
6. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and manufacturer's instructions for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
7. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
8. Install acoustic sealant where indicated.
9. Seal penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and.
10. Erect glass mat gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
11. Use screws when fastening gypsum board to metal furring or framing.
12. Place control joints consistent with lines of building spaces as indicated on Drawings. as directed.
13. Place corner beads at external corners as indicated on Drawings. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
14. Install cementitious backer board in the following locations:
    a. Shower walls.
    b. Rear and side walls (wet walls) adjacent to lavatories, toilets, and urinals.
15. Install moisture resistant gypsum board in the following locations:
    a. Behind wall tile.
    b. Toilet room walls not receiving cementitious backer board.
16. Install abuse-resistant gypsum board at areas as indicated in the drawings.
17. Apply gypsum board to curved walls in accordance with GA-216.

G. Joint Treatment and Floating:
1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
2. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.
3. Float solid between any corner beads or J-molds less than 36” apart to eliminate tapered or concave appearance.
4. Float control joints flush with wall surface so that ceiling trim will run straight without gaps or deformation.
5. Finish cementitious backer board in accordance with manufacturer’s instructions.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect shall conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

B. Notify Architect seven days in advance of date and time when Project, or part of Project, is to be ready for above-ceiling observation.

C. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
1. Installation of 80 percent of lighting fixtures, powered for operation.
2. Installation, insulation, and leak and pressure testing of water piping systems.
3. Installation of air-duct systems.
4. Installation of air devices.
5. Installation of mechanical system control-air tubing.
6. Installation of ceiling support framing.

3.6 SCHEDULES

A. Finishes in accordance with GA-214 Level:

1. **Level 1:** Embed tape at joints in ceiling plenum areas, concealed areas, on portions of walls above ceilings between the ceilings and the tops of walls and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.

2. **Level 2:** Embed tape and apply first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile.

3. **Level 3:** Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where panels are substrate for medium or heavy textures or heavy-grade wallcoverings. Verify with wallcovering installer that gypsum board finish is acceptable for wallcovering application.

4. **Level 4** (Standard Finish): Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges where panels are substrate for light textures, flat paints, or standard vinyl wallcoverings.

5. **Level 5:** Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where panels are substrate for gloss or semi-gloss paints.
   a. Provide at drywall panels in high-level natural or artificial lighting areas such as near glazed entries, clerestory windows, or down-lighting mounted on or near walls.
   b. Provide at drywall scheduled to receive dry-erase coatings or wall coverings to be used as dry-erase marker surfaces.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Porcelain floor and wall tile and matching base.
2. Marble thresholds at restroom entries.
3. Sealant joints at all tile inside corners.
4. Radiused aluminum trim at all tile outside corners.
5. Control joints in accordance with TCNA standards and recommendations.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Troweling of floor slab for tile application.
2. Section 07 13 00 – Sheet Waterproofing.
3. Section 07 90 00 - Joint Protection.
4. Section 09 21 16 - Gypsum Board Assemblies: Moisture resistant gypsum board and cementitious backer board for wall tile application.
5. Section 10 28 10 – Metal caps at tiled restroom wing walls.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
2. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
3. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
4. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
5. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
7. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
8. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
9. ANSI A118.4 – Modified Dry-Set Cement Mortar.
10. ANSI A118.6 - Ceramic Tile Grouts.
11. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
12. ANSI A118.15 – Improved Modified Dry-Set Cement Mortar
13. ANSI A137.1 - Ceramic Tile.

B. Tile Council of North America:
1. TCNA - Handbook for Ceramic Tile Installation.

C. International Standard Organization:
1. ISO 13007 – Standards for Ceramic Tiles, Grouts, and Adhesives.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.

C. Product Data: Submit manufacturer’s printed instructions for using grouts and adhesives.

D. Samples:
   1. For each type and color of tile specified, submit mounted tile and grout on two plywood panels, at least 12 x 12 inch in size, illustrating pattern, color variations, and full range of grout joint size variations.
   2. Submit 2 full-size units of each trim and accessory.
   3. Submit marble thresholds in 6-inch lengths.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TCNA Handbook and ANSI A108 Series/A118 Series.

B. To ensure warranty requirements and compatibility of products provide all tile grout, setting materials, additives, accessories, and factory-prepared dry-set mortars from the same manufacturer.

C. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

D. Installer: Company specializing in performing Work of this section with minimum three years' experience and approved by tile manufacturer.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect adhesives and grouts from freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install adhesives and grouts in unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one unopened box of each type and color of ceramic tile installed, including accent colors, to the Owner. Obtain receipt.

C. Furnish two unopened boxes of each type and color of porcelain tile installed, including accent colors, to the Owner. Obtain receipt.

D. Furnish one unopened box of each type and color of ceramic tile installed, including accent colors, to the Owner. Obtain receipt.

E. Furnish one unopened box of each type and color of quarry tile installed, including accent colors, to the Owner. Obtain receipt.

PART 2 - PRODUCTS

2.1 TILE

A. Tile Manufacturers: Refer to specific manufacturers and products indicated in the Drawings to determine the Project requirements. Subject to compliance with requirements, provide products indicated or equal product by one of the following manufacturers, unless a specific product is referenced as “No Substitutions”.

1. Acceptance of products other than those indicated is contingent upon submittal of proposed alternate products to the Architect. Submittal of proposed alternate products must occur prior to bidding as described in Division One specification section “Product Substitutions”.

2. Submittals must demonstrate to the Architect that the proposed alternate product line has colors that match the basis-of-design indicated. The Architect may reject the proposed product for technical non-compliance or, at his discretion, on the basis of lack of color match alone.

B. Manufacturers:
1. American Marazzi Tile, Inc.
2. American Olean; Div. of Dal-Tile International Corp.
3. American Tile Supply.
4. Crossville Ceramics Company, L.P.
5. Daltile; Div. of Dal-Tile International Inc.
6. Monarch Tile, Inc.
7. Summitville Tiles, Inc.
8. United States Ceramic Tile Company.
9. Additional manufacturers as may be listed in the Finish/Color Schedule.
10. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 COMPONENTS – Tile Types correspond to Types indicated on the Finish/Color Schedule:

A. Porcelain Wall Tile - ANSI A108/118, conforming to the following:
1. Manufacturer: Manufacturer, style and color as scheduled.
2. Sizes: As indicated.
3. Shape: Rectangular, field cut as required.
4. Edge: Square.
5. Joint Size: 1/8”.
6. Surface Finish: Glazed or unglazed as scheduled.
7. Type: Rectified, through-color.
8. Base: Tile base as scheduled.
9. Use sanded latex-Portland cement grout except at showers or where otherwise indicated for epoxy.

B. Porcelain Floor Tile - ANSI A108/118, conforming to the following:
1. Manufacturer: manufacturer, style and color as scheduled.
2. Sizes: As indicated.
3. Shape: Square, field cut as required.
4. Edge: Cushioned.
5. Joint Size: 1/8”.
6. Surface Finish: Unglazed as scheduled.
7. Type: Through-color.
8. Base: 6” high coved, flush with floor and wall tile.
9. Use sanded latex-Portland cement grout except at showers or where otherwise indicated for epoxy.

2.3 ACCESSORIES

A. Mortar Materials:

1. Manufacturers:
   a. Ardex Americas, www.ardexamericas.com
   b. Bonsal, W. R., Company
   c. Bostik www.bostik.com/bostikusa.html
   d. C-Cure Corporation www.c-cure.com
   e. Laticrete International, Inc. www.laticrete.com
   f. Mapei Corporation www.mapei.com
   g. TEC Specialty Products Inc.
   h. Substitutions: Section 01 60 00 - Product Requirements.

2. Mortar Bed Materials at Recessed Slabs: ANSI A108.1A; Portland cement, sand, latex additive, and water; proportioned in accordance with TCNA specifications.

3. Mortar Bond Coat Materials:
   a. General: Latex-Portland Cement single-component type polymer-modified thin-set or medium bed mortar.
   b. Basis of Design:
      1) Small Format Floor or Wall Tile (all dimensions less than 15”): *Ultraflex-2* thin-set as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4E, ANSI A118.11, and ISO C2TE.
      2) Large Format Floor Tile (any dimension 15” or greater): *Ultraflex-LFT* medium bed as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4, ISO 13007 C2TES1P1, and TE and ANSI A118.11.
      3) Large Format Wall Tile (any dimension 12” or greater): *Ultralite Pro* non-sag type as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4TE, ANSI A118.4TE, and ISO 13007 C2TE.

B. Grout Materials:
1. Manufacturers:
   a. Ardex Americas, www.ardexamericas.com
   b. Bonsal, W. R., Company
   c. Bostik www.bostik.com/bostikusa.html
   d. C-Cure Corporation www.c-cure.com
   e. Laticrete International, Inc. www.laticrete.com
   f. Mapei Corporation www.mapei.com
   g. TEC Specialty Products Inc.
   h. Substitutions: Section 01 60 00 - Product Requirements.

2. Sanded Grout: Calcium Aluminate Cement type that meets or exceeds requirements of ANSI A118.6.
   a. Color: As selected.
   b. Basis of Design: *Ultracolor Plus FA* as manufactured by Mapei or approved equivalent by specified manufacturer.
   c. Application: For non-epoxy joints 1/16” or greater.
   d. Use acid-resistant grout at restrooms, unless indicated as epoxy.

3. Non-Sanded Grout: Latex-Portland cement polymer-modified type that meets or exceeds requirements of ANSI A118.6.
   a. Color: As selected.
   b. Basis of Design: *Keracolor-U* as manufactured by Mapei or approved equivalent by specified manufacturer.
   c. Application: For non-epoxy joints less than 1/16”.

d. Use acid-resistant grout at restrooms, unless indicated as epoxy.

4. Epoxy Grout: 100% solids, chemical-resistant, industrial-grade modified epoxy grout suitable for use in commercial kitchens; Meets or exceeds requirements of ANSI A118.3.
   a. Color(s) as selected.
   b. Basis of Design: *Kerapoxy-IEG CQ* as manufactured by Mapei or approved equivalent by specified manufacturer.
   c. Application: Use for quarry tile applications, showers, and where specifically indicated.

C. Waterproofing Membrane at showers: Not applicable.

D. Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

E. Crack Control Membrane: At substrate cracking and construction/expansion joints in dry areas, provide liquid-applied or sheet membrane meeting or exceeding requirements of ASTM C627. Use with reinforcing fabric:

1. For Covering Shrinkage Cracking and Non-Structural Cracks to less than 1/8” - Use one of the following:
   a. *Mapelastic C1* as manufactured by MAPEI: Liquid-applied.
   b. *Blue 92* as manufactured by Laticrete: Liquid-applied.
   c. *Mapeguard 2 with SM Primer* as manufactured by MAPEI: Sheet
   d. *NobleSeal CIS* as manufactured by Noble Corp: Sheet.
2. For Bridging Construction Joints and Any Cracks 1/8” or greater– Use one of the following membrane sheets meeting or exceeding requirements of ASTM C627-*Extra Heavy*:
   a. *Mapeguard 2 with SM Primer* as manufactured by MAPEI.
   b. *Crack Isolation Mat* as manufactured by Laticrete.
   c. *NobleSeal CIS* as manufactured by Noble Corp.
   d. In addition install sealant-filled control joint at or within 12” of construction joints or any joints exceeding 1/4” in width.

F. Cementitious Backer Board: As specified in Section 09 21 16 for use at shower walls.

G. Marble Thresholds: Provide at each entry door or framed opening to restrooms or restroom vestibules.

1. Material: Carrara white marble, Grade A.
2. Configuration: One-piece material, 2-in. wide x full width of door. ADA compliant with long edges beveled and top surface of threshold 3/8” – 1/2” higher than finish flooring on either side.
3. Finish: Sealed with clear non-yellowing penetrating sealer.
4. Location:
   a. Door: Center threshold on door.
   b. Opening without door: Center on wall opening or frame.

H. Trowelable Underlayments and Patching Compounds: Latex-modified cementitious type, Planiprep SC as manufactured by MAPEI Corporation or approved equivalent by ARDEX Engineered Cements.

I. Metal Edge Strips: Furnish metal edge and transition strips with integral provision for anchorage to mortar bed or substrate at all outside corners and exposed tile edges.
   1. Manufacturers:
      a. Schluter-Rondec, www.schluter.com.
      b. Substitutions: Section 01 25 00 – Substitution Procedures.

   2. Transition Strips – Typical:
      a. Tile to concrete floor, hard-surface floor, and resilient flooring: Schluter-RENO-U, aluminum.
      b. Tile to Carpet: Schluter-RENO-TK, aluminum
      c. Top of Wainscot Edge Strip: Schluter-JOLLY, extruded clear satin anodized aluminum.
      d. Floor Transition at Restrooms: Specified marble threshold.

J. Wing Wall Metal Caps: Reference Section 10 28 10.

K. Steel Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size, galvanized welded fabric for mortar beds.

L. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

   1. MAPEI *Ultracare Stone, Tile & Grout Care* Solutions or approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Mix and install leveling and patching compound in accordance with underlayment manufacturer’s printed instructions. Fill low spots and grind high spots to bring floor to level.

D. Install crack control membrane at substrate cracking and construction/expansion joints in accordance with membrane manufacturer’s printed recommendations.

E. Install liquid-applied membrane at shower floors and walls prior to tile installation. Prepare surfaces and install in strict accordance with waterproofing membrane manufacturer’s printed recommendations.

F. Seal substrate surface cracks with filler.

G. Prepare substrate surfaces for adhesive installation.

3.3 INSTALLATION

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCNA Handbook recommendations.

B. Lay tile to patterns indicated. Do not interrupt tile pattern through openings.

C. Place metal edge strips at exposed tile edges.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.

E. Joints: Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
   1. Ceramic or Porcelain Floor or Wall Tile:
      a. 1” x 1” to 4” x 4” Tile: 1/16-inch.
      b. 6” x 6” to 12” x 12” Tile: 1/8-inch
      c. Large Format Tile, Rectified: 1/8 inch.
      d. Large Format Tile, Non-Rectified: 1/4 inch – 3/8 inch.

F. Control Joints: Locate sealant-filled control joints in accordance with TCNA standards and recommendations and the approved shop drawings.
   1. Provide 1/8” gap and sealant fill at all inside tile corners.
   2. Pay special attention to areas where large temperature variations may occur on the flooring, such as at glazed entry or windowed areas.

G. Form internal angles square and external angles bullnosed.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control joints free of adhesive or grout. Apply sealant to joints.

J. Allow tile to set for a minimum of 48 hours prior to grouting.

K. Grout tile joints.

L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

M. Installation - Floors - Thin-Set or Medium Bed Methods:
   1. Over interior concrete slabs, install with latex-Portland cement grout in accordance with TCNA Handbook Method F113-14 for slabs-on-grade and A113A-14 for slabs-above-ground:
      a. Where waterproofing membrane is indicated, install in accordance with TCNA Handbook Method F122, with latex-Portland cement grout.

N. Installation - Floors - Mortar Bed Methods at Recessed Slabs:
   1. Over interior concrete slabs, install in accordance with TCNA Handbook Method F112, bonded, with latex-Portland cement grout.
      a. Where waterproofing membrane is indicated, install in accordance with TCNA Handbook Method F121., with.
      b. Use latex-Portland cement grout. At showers or where quarry tile is indicated, install in accordance with TCNA Handbook Method F112 with epoxy grout.

O. Installation - Wall Tile:
   1. Over cementitious backer units install in accordance with TCNA Handbook Method W244, with Portland-cement grout.
   2. Over moisture-resistant gypsum wallboard, install in accordance with TCNA Handbook Method W243, with latex-Portland cement grout.
      a. Over concrete masonry, install in accordance with TCNA Handbook Method W202,
      b. Use latex-Portland cement grout. At showers use epoxy grout.

P. Door Transitions/Thresholds: Reference Door Schedule for type:
   1. Marble Stone Thresholds: Install where edge of tile flooring is exposed in wet areas.
   2. Metal Edge Strips:
      a. Install floor transition strips at all floor tile terminations where stone thresholds are not installed.
      b. Install wall edge strips at exposed edges of tile where wall tile terminates away from inside corners.

Q. Install waterproofing membranes as specified in Section 07 13 00.

R. When bonding large-format tiles, install in accordance with TCNA and tile manufacturer’s recommendations to achieve full coverage of mortar bed under tile surface. Back-butter tiles as necessary to ensure full coverage.

S. Grout Sealing: Apply clear sealer to cementitious grout joints in wall and floor tiling according to sealer manufacturer's written instructions.
1. Allow sealer to penetrate grout joints and remove excess sealer from tile faces by wiping with soft cloth.
2. Apply minimum one coat sealer to wall joints and minimum two coats to floor joints.
3. Use sealers approved by both the tile and grout manufacturers.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean tile and grout surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over finished floor surface for 4 days after installation.

C. Keep epoxy grout free of construction drywall dust until fully cured, as determined by the epoxy grout manufacturer.

END OF SECTION

SECTION 09 51 13 – LAY-IN ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Section includes acoustical ceiling panels in suspended grid.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   5. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
   6. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association:
   1. CISCA - Acoustical Ceilings: Use and Practice.

C. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension system members.
   2. Method of attaching suspension system hangers to building structure.
   3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
   4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

C. Product Data: Submit data on acoustic units, metal grid system components, and perimeter trim.

D. Samples:
   1. Submit two samples, 6 x 6 inch in size, of each type of acoustic panel specified.
   2. Submit two samples, 12 inches long, of each type of exposed suspension system specified.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

F. Certification: Provide certification from manufacturer of products that all materials used in food preparation and food serving areas have USDA approval for use in food preparation and food serving areas.

1.4 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Certify all materials used in food preparation and food serving areas have USDA approval for use in food serving and food preparation areas.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum three years' experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat or air conditioning is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 2 percent of total acoustic unit area of extra panels to Owner.

C. Furnish 1 box of suspension system material to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels
1. Armstrong World Industries, Inc., www.armstrong.com
2. CertainTeed/Saint Gobain, www.certainteed.com

3. USG Interiors, Inc., www.usg.com
4. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Suspension Grid
1. Basis of Design: Armstrong, Prelude XL 15/16” Exposed Tee.
   a. Armstrong World Industries, Inc., www.armstrong.com
   b. BPB America.
   c. CertainTeed/Saint Gobain, www.certainteed.com
   d. Chicago Metallic Corporation, www.chicagometallic.net
   e. USG Interiors, Inc., www.usg.com
2. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 COMPONENTS

A. **APC-1**: ASTM E1264, Type IV conforming to the following:
1. Basis of Design: *School Zone Fine Fissured #1713* as manufactured by Armstrong or approved equivalent by specified manufacturer.
   a. Typical locations: Primary learning areas and classrooms, or as noted in drawings.
2. Size: 24 x 24 inches.
3. Thickness: 3/4 inches.
4. Composition: Mineral fiber, wet-formed.
5. NRC: 0.70.
6. CAC: 35.
7. Edge: Square lay-in.
8. Surface Color: White, typical.
9. Surface Finish: Fine texture, no pattern.
10. Special Treatment: HumiGuard Plus and BioBlock.
11. Grid: 15/16” wide, factory powder coat white, Prelude XL.

B. **APC- 2 :** ASTM E1264, Type VII conforming to the following:
1. Basis of Design: *Clean Room VL #870* as manufactured by Armstrong or approved equivalent by specified manufacturer.
   a. Restrooms, Food Prep areas or as noted on drawings.
2. Size: 24 x 24 inches.
3. Thickness: 5/8 inches.
4. Composition: Mineral fiber, wet-formed.
5. Light Reflectance Coefficient: 0.80.
6. CAC: 40.
7. Edge: Square edge.
8. Surface Color: White, typical.
9. Surface Finish: Vinyl-faced membrane, smooth texture, non-perforated.
10. Special Treatment: Bioblock.
11. Grid: 15/16” wide, factory powder coat white, Prelude XL.

C. **APC-3**: ASTM E1264, Type IV conforming to the following:
1. Basis of Design: *Calla* as manufactured by Armstrong or approved equivalent by specified manufacturer.
2. Size: 24 x 24 inches.
3. Thickness: 1-inches.
4. Composition: Mineral fiber, wet-formed.
5. Light Reflectance Coefficient: 0.80.
6. NRC: 0.85.
7. CAC: 35.
8. Edge: Square tegular edged.
9. Surface Color: White, typical.
10. Surface Finish: Fine texture, no pattern.
11. Special Treatment: *HumiGuard Plus.*
12. Grid: 9/16” wide factory white steel.

D. **APC-4:** Black Color Acoustic Panels: ASTM E1264, conforming to the following:
1. Manufacturers:
a. Armstrong World Industries, Inc. www.armstrong.com
b. CertainTeed Ceilings, www.certainteed.com
c. USG Interiors, Inc. www.usg.com
d. Substitutions: Section 01 60 00 - Product Requirements.
2. Basis of Design: Fine Fissured Humiguard Plus as manufactured by Armstrong.
3. Size: 24 x 24 inches.
4. Thickness: 5/8 inches.
5. Composition: Mineral.
6. Light Reflectance Coefficient: 0.80.
7. NRC: 0.55.
8. Edge: Square.
9. Surface Color: “Tech Black”.
10. Surface Finish: Fissured.
11. Grid: 15/16” factory black finished steel.

E. Grid:
1. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking.
a. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
b. Basis of design, Prelude XL as manufactured by Armstrong or approved equivalent by specified manufacturer.
c. Grid Finish:
1) Factory painted white or black steel face as scheduled.
2) 15/16” face typical.95/16” face for tegular edged tile.
2. Accessories: Stabilizer bars, clips, splices, perimeter moldings, hold down clips, and other items required for suspended grid system.
a. For circular penetrations of ceiling, provide perimeter moldings fabricated to diameter required to fit penetration exactly.
3. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
a. Post-installed Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
b. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper. Select wire diameter so its stress at three times hanger design load will be less than yield stress of wire but provide not less than 0.106 inch diameter wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify layout of hangers will not interfere with other work.

3.2 EXISTING WORK

A. Extend existing acoustical ceiling installations using materials and methods as specified.

B. Clean and repair existing acoustical ceilings which remain or are to be reinstalled.

3.3 INSTALLATION

A. Lay-In Grid Suspension System:

1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
2. Install system capable of supporting imposed loads to deflection of 1/360 maximum.
3. Lay out system to balanced grid design with edge units no less than 50 percent of acoustic unit size.
4. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
5. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, and provide hangers not more than 8 inches from ends of each member.
8. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
9. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
10. Do not eccentrically load system or produce rotation of runners.
11. Perimeter Molding:
    a. Install edge molding at intersection of ceiling and vertical surfaces.
    b. Use longest practical lengths.
    c. Overlap corners.
    d. Do not use exposed fasteners, including pop rivets, on moldings and trim.
    e. Install at junctions with other interruptions.

B. Acoustic Units:
1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
2. Fit border trim neatly against abutting surfaces.
3. Install units after above-ceiling work is complete.
4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
5. Cut to fit irregular grid and perimeter edge trim.
6. Where round obstructions occur, install preformed closures to match perimeter molding.
7. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 54 26 – DECORATIVE WOOD CEILING AND WALL PANEL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Factory finished suspended decorative contoured wood panel ceiling systems.
   2. Factory finished wall-mounted decorative flat wood panel ceiling systems.

B. Related Sections include the following:
   1. Division 5 Sections for steel building structure: Spacing of structural members for suspension of ceiling panels.
   2. Section 09 90 00 – Painting and Coating:
      a. Field painting of structure, deck, piping, ducts, and suspension systems above suspended decorative wood ceiling Panels.
      b. Field painting of wall substrate behind decorative wood panels.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s printed descriptive data indicating details materials, finish, and installation for the panel systems.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling and wall system layouts within floor plan and elevations of Auditorium.
   2. Ceiling suspension system members.
   3. Method of attaching suspension system hangers to building structure.
   4. Method of attaching wall system to substrate.
   5. Provide coordination drawings for wall and ceiling systems with light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of suspended ceiling panels with adjoining construction.
   6. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

C. Physical Samples:
   1. Minimum 6” x 6” cuts of factory finished wood samples in selected finish showing full range of color and grain.
   2. Manufacturer’s wall and ceiling mounting clips.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Test Reports: Indicate compliance of acoustical panel ceiling and wall components with requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: The installer must have a minimum of two (2) years’ experience in installation of similar systems. The installer must be acceptable to the Architect, manufacturer, and Owner's representative.

B. Fire Performance Characteristics: Wood panels shall conform to Class 1, or A flame spread rating, when tested according to ASTM E-84.

C. Environmental Standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the project site in the original, labeled, unopened packages.

B. Materials shall be stored flat and level in a dry, fully enclosed space. For a minimum of seventy-two (72) hours immediately prior to ceiling installation, the Wood Ceiling Systems shall be stored in the room in which they will be installed. The temperature and humidity of the room shall closely approximate those conditions that will exist when the building is occupied. Wood Ceiling Systems shall be stored off the floor. Products must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Handle ceiling units carefully to avoid chipped edges or damage to units.

1.7 PROJECT CONDITIONS

A. Installation shall be done only when the temperature and humidity closely approximate the interior conditions that will exist when the building is occupied. The heating and cooling systems shall be operating before, during, and after installation, with the humidity of the interior spaces maintained between 25% and 55%. Wood ceiling materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation.

B. Prior to the start of installation, all exterior windows and doors are to be in place, glazed, and weather-stripped. The roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry.

C. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed. No materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.

1.8 WARRANTIES

A. Manufacturer:
1. Wood panels: All materials supplied by the system manufacturer shall be guaranteed against manufacturing defects for one (1) year from date of Substantial Completion of the Project.
2. Suspension System: 10 years from date of Substantial Completion of the Project.

B. Installer: Materials and workmanship shall be guaranteed for a minimum of one (1) year from Substantial Completion of the Project.

PART 2 - PRODUCTS

2.1 WOOD PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Architectural Components Group, Inc. www.acgiwood.com
2. Armstrong World Industries, Inc. www.armstrong.com
3. Rulon Company www.rulonco.com
4. Norton Industries

B. Basis of design, *Woodworks Allegro Series 3 Wood Panels* for walls and suspended ceilings as manufactured by Armstrong or approved equivalent by specified manufacturer.

C. Description:
   1. Module Size(s): Face sizes as indicated. Nominal 48-inch x 96-inch x 4-1/2” depth for receiving encapsulated acoustic insulation.
   2. Reveals: Uniform 3/4" between panels.
   3. Factory Finish: Satin clear finished Walnut wood veneer. Finish and color to match Architect’s sample.
   4. Acoustics: Standard factory-applied black-color acoustic fleece to cover each open reveal. NRC 0.45 or better.
   5. Ceiling Suspension System: Steel Unistrut channels suspended by minimum 14” all-threaded steel rods anchored to overhead building structure.
   6. Wall Supporting System: Manufacture’s standard steel concealed clips, screw-fastened through drywall into metal studs.

D. Fire Performance:
   1. Flame Spread Index: 25 or less per ASTM E84.
   2. Smoke Developed Index: 50 or less per ASTM E84.
   3. Rated Fire Classification “A” per ASTM E1264.

3.2 ACCESSORIES

A. Ceiling Clips: System manufacturer’s black painted custom spring steel mounting clips for fastening panel backer strips to suspension tees.
   1. Wall Clips: System manufacture’s black painted clips custom concealed mounting clips, screw-fastened through wall substrate into metal studs.
   2. Wall Molding Trim: Not required.

B. Acoustical Insulation: Manufacturer’s encapsulated fiberglass batts.

3.3 CEILING SUSPENSION SYSTEM

A. Structural Classification: Heavy-Duty System.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
   1. Post-Installed Powder-Actuated Fasteners for Hardrock Concrete Floor Decking:
      a. Fastener system of type suitable for application indicated.
      b. Capability to sustain without failure a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190.
   2. Make all connections to overhead building structure with no connections to metal decking. Provide secondary Unistrut framing channels between and directly connected to building structure where structure does not provide proper alignment for threaded suspension rods.
   3. For required penetrations of ceiling panels, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ceiling Layout: measure ceiling areas and establish the layout of the hanger rods and clips, in accordance with system manufacturer’s installation instructions.

B. Environmental Conditions: Store system materials in the area of installation for a minimum of 48 hours prior to installation, with the following environmental conditions maintained:
   1. Relative Humidity: Between 25% and 55%.
   2. Temperature: Between 50^{O} F and 86^{O} F.
   .

3.2 CEILING SYSTEM INSTALLATION

A. General: Install materials in accordance with manufacturer's instructions and processed submittals. Comply with applicable regulations and industry standards.

B. Install suspension system and panels in compliance with the authorities having jurisdiction, and in accordance with the manufacturer's installation instructions.

C. Suspend threaded suspension rods overhead building structure and secondary framing spaced at nominal 4-feet centers, with a minimum of four (4) hangers per 4 ft x 8 ft panel. Install hanger rods plumb and straight.
   1. Suspension system must be leveled to within 1/4-inch in 10 feet and must be square to

   2. Linear carriers must be supported not more than 2-feet from the ends and 4' on center along their length.

D. Provide any cut panel edges that are exposed to view will have to be treated to match factory edges using pre-finished edges to match factory original.

3.3 WALL PANEL INSTALLATION

A. General: Install materials in accordance with manufacturer's instructions and processed submittals. Comply with applicable regulations and industry standards.

B. Install nominal ¼" deep zee clip system and panels in compliance with the manufacturer's installation instructions.

C. Mount wall panels to manufacturer's clips with all edges parallel and perpendicular to building lines.

D. Provide any cut panel edges that are exposed to view will have to be treated to match factory edges using pre-finished edges to match factory original.

3.4 ADJUSTMENT, CLEANING AND REPAIR

A. Contractor shall clean all completed wood panel systems according to manufacturer's recommended maintenance procedures, and protect from damage and dust. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Contractor shall make final adjustments to level, plumb, and plane of panels.

C. All work that cannot be successfully cleaned or repaired, shall be removed and replaced. Deficiencies in the installed ceiling, including finishes, shall be corrected at no additional cost to the Owner.

END OF SECTION

SECTION 09 64 99 - WOOD FLOOR PAINTING and REFINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Refurbishing and refinishing of existing natural finish Oak steps and proscenium floor edge trim at auditorium stage.
2. Sanding and repainting of existing painted wood flooring at auditorium stage.
3. Painting of new plywood floor covering at existing Black Box theater.

B. Related Sections:
1. 06 20 24 – Interior Finish Carpentry and Millwork: Repair of existing Oak stage floor edge bullnose trim.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data for proposed stain and finish.

C. Samples:
1. Submit two samples of finished Oak, nominal 12” x 12”, illustrating the proposed natural finish for stage steps and trim.
2. Submit two samples of finished pineOak, nominal 12” x 12”, illustrating the proposed natural finish for stage steps and trim.
3.
4. After sample review, apply selected stain and finish to a nominal 4’ x 4’ sanded area of the existing floor for final approval.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

1.4 QUALIFICATIONS

A. Installer/Applicator: Company specializing in performing work of this section with minimum three years’ experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Review installation procedures including procedures for acclimation of flooring materials.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not begin floor refinishing operations until wet construction work is complete and ambient air at installation space has moisture content stabilized between 35 and 50 percent and temperature is stabilized between 65 and 80 degrees F.

C. Provide heat, light, and ventilation prior to installation.

D. Maintain room temperature and humidity at affected space for period of two days prior to beginning refinishing operations, and continuously after completion of refinishing operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Natural Wood Finish: Stain and Finish: "Duraseal" stain and solvent-based satin polyurethane sealer/finish

A. Paint Finish: “Tough Prime” acrylic scene shop paint as manufactured by Rosco. Satin black color. Two coats.

B. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

C. Sanding and Smoothing Media:
1. Sanding Paper: Aluminum oxide rolls and disks precut to size for the particular power sanding machines.
2. Steel wool in 000 and/or 0000 grade.
3. Synthetic steel wool: 3M Scotch-Brite pads in 000 or 0000 grade equivalent.

PART 3 EXECUTION

3.1 EXAMINATION and PREPARATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Broom clean substrate.

3.2 INSTALLATION

A. Sanding:
1. Lightly sand flooring and trim to ensure proper adhesion of new finishes. Use random orbital hand sander on steps and trim, and random orbital professional floor sander on painted flooring. Use no rotary sanders.
2. Final sanding shall be with No. 0 or 00 parallel with the grain. Provide additional sanding if required by the Architect to achieve smooth finish.

B. Sweep and vacuum floor to remove all traces of sanding dust. Use tack rags immediately prior to applying natural finish or paint.

C. Protect finished flooring from traffic for a minimum of 72 hours after final coat. Cover flooring with sheets of hardboard or kraft paper to protect from traffic.

3.3 FINAL CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Solid vinyl tile flooring (“Luxury Vinyl”).
   2. Rubber base: Provide and install rubber base where scheduled throughout the project, regardless of floor finish

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete: Substrate finishing and curing.

1.3 REFERENCES

A. ASTM International:
   1. ASTM F1066 – Standard Specification for Vinyl Composition Floor Tile.
   2. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
   3. ASTM F1861 - Standard Specification for Resilient Wall Base.
   4. ASTM-F2170-11 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using in situ probes.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples:
   1. Submit manufacturer's complete set of color samples for initial selection.
   2. Submit two full size samples of each tile and base item specified.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience.

C. Substrate Preparation: Coordinate with concrete installer to provide substrate finish and curing method compatible with flooring materials and adhesives. Certain materials specified herein are not compatible with chemical curing methods.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store tiles on flat surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F

PART 2 - PRODUCTS

2.1 VINYL TILE FLOORING

A. Manufacturers:
1. Armstrong Commercial Flooring www.armstrong.com
2. Mannington Commercial www.mannington.com
3. Tandus-Centivia, www.tandus-centiva.com
4. Tarkett Johnsonite Floor Covering, www.commerical.tarkett.com
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Luxury Vinyl Tile: ASTM F1700, Class 3, Type B
1. Basis of Design: Tarkett or approved equivalent in composition, color, pattern, and performance as approved by the Architect.
2. Face Size: 18” x 18”.
3. Colors, and Patterns: As indicated on the Materials Schedule.
4. PVC Wear Layer: 20 mil and 32 mil wear layer as indicated.
5. Manufacturer’s Warranty: 20-years.
6. Colors/Patterns: As indicated.

2.2 RESILIENT BASE

A. Manufacturers:
1. Armstrong World Industries www.armstrong.com
2. Burke Mercer Flooring Products www.burkeflooring.com
3. Johnsonite www.johnsonite.com
4. Marley Flexco www.flexcofloors.com
5. Roppe Corporation www.roppe.com
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Rubber Base: ASTM F1861, rubber, Type TP:
1. Height: 4 inch.
2. Thickness: 1/8 inch.
3. Finish: Smooth.
4. Length: Continuous rolls.
5. Style: Coved with top-set toe.

2.3 ACCESSORIES

A. Subfloor Filler: Self-leveling latex-modified cementitious type, ARDEX SD-F “Feather Finish” as manufactured by Ardex Engineered Cements.

B. Adhesives:
1. Flooring Adhesive: Waterproof solvent-free type recommended by the flooring manufacturer. Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
2. Base Adhesive: Latex type as recommended by the rubber base manufacturer.

C. Moldings and Edge Strips: Extruded aluminum, one edge tapered, of height necessary to flush with tile thickness.

2.4 EXTRA STOCK

A. Deliver to the Owner:

1. Four (4) percent or one (1) unopened carton of each color and pattern of flooring selected, whichever is greater.

2. Four (4) percent or one (1) unopened carton of each color, type, and size base selected, whichever is greater.

3. One (1) gallon container of each type adhesive used for flooring and base.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify new concrete substrates are dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

1. Maximum allowable amount of moisture emission from substrate is 3.0 pounds per 1,000 square feet in 24-hour period and shall not exceed maximum allowable moisture content as recommended or allowed by flooring manufacturer.

2. Perform deep-probe moisture meter testing per ASTM-F2170 for each area receiving the specified floor finish. Provide written test results to the Architect, along with flooring manufacturer’s recommended maximum moisture values.

C. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials. Starting installation of flooring indicates installer’s acceptance of flooring substrate conditions.

3.2 PREPARATION

A. At existing floors, remove flooring and shot-blast exposed concrete slab to clean white finish with slight texture for proper adhesion.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

1. Prohibit traffic until filler is cured.

2. Clean substrate.

C. Apply flooring manufacturer’s recommended primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed.

B. Uniformly spread manufacturer’s approved adhesive using notched trowel at a spread rate as recommended by the manufacturer.

1. Lay flooring with joints and seams butted tight and parallel to building lines to produce symmetrical tile pattern.

2. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

4. Install edge strips at unprotected or exposed edges, where flooring terminates, and where flooring materials change.

5. Install flooring in recessed floor access covers designed for finish material installation. Maintain floor pattern.

6. At movable partitions, install flooring under partitions without interrupting floor pattern.

7. Extend flooring into knee recesses under casework and other recesses.

3.4 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Use factory-preformed exterior corners, and factory preformed or job-mitered interior corners. Do not wrap exterior corners without express approval of the Architect.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean, seal, and maintain resilient flooring products.

3.6 STRIPPING AND WAXING: Provided by Owner.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on resilient flooring for 48 hours after installation.

C. Do not slide furnishings, equipment, or other objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels. Remove and replace damaged tiles.

END OF SECTION

SECTION 09 66 13 - PORTLAND CEMENT TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Sand cushion terrazzo floor.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Concrete subfloor with broom finish.
2. Section 07 90 00 - Joint Protection: Expansion/control joints.

1.2 REFERENCES

A. ASTM International:
1. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

B. National Terrazzo and Mosaic Association:
1. NTMA - Terrazzo Specifications Guide.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate divider strip layout, control joint and expansion joint layout, flooring material transitions, color patterns, and details of adjacent components.

C. Product Data: Submit data for each type of terrazzo, material, and accessory specified.

D. Samples for Initial Selection: National Terrazzo and Mosaic Association color plates showing the full range of colors available for each terrazzo type indicated.

E. Samples for Verification: Submit two samples, 6 x 6 inch in size illustrating color, chip size and variation, chip gradation, mortar color, and typical divider strip.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit procedures for stain removal, stripping, and sealing.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NTMA recommendations contained in "Terrazzo Information Guide."

B. Source Limitations for Marble: Obtain each color, grade, type, and variety of marble from one source with resources to provide materials of consistent quality in appearance and physical properties without delaying the Work.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience and with a record of successful in-service performance.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section. Review methods and procedures related to installation including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review dust-control procedures.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.

C. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of terrazzo.

D. Provide ambient lighting level of 50-ft candles, measured at floor surface.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of terrazzo divider strips with location of mechanical and electrical access covers, floor mat frames, and other items built into terrazzo.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type 1 Normal; white color for topping mix; gray color for underbed; modified to NTMA higher compressive strength requirements; obtained from single source.

B. Color Pigments for Topping: Non-fading mineral type, alkali-resistant.

C. Terrazzo Sand: ASTM C33, fine aggregates; sharp, coarse, clean, screened, and free of deleterious material.

D. Cushion Sand: ASTM C33, clean and free of deleterious material.

E. Water: Potable.

F. Surface Aggregate: Reference Color/Finish Schedule for aggregate types.

1. Crushed Marble: No. 0 - 1 size in accordance with NTMA chip size for standard gradation and uniform coloration.

2.2 ACCESSORIES

A. Underbed Reinforcing Mesh: ASTM A185; 2 x 2 inch x 18 gage, galvanized.

B. Divider Strips: 1/16, 1/8, and 1/4 inch thick white alloy of zinc top strips, galvanized steel bottom strip, with anchoring features. Reference drawings for use of different width divider strips for the indicated pattern.

C. Control Joint Strips: Separate, double-L type angle or straight strips positioned back-to-back, matching material, thickness, and color of divider strips.

D. Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

E. Slip Sheet: ASTM D2103; 4 mil polyethylene sheet; or ASTM D226 Type 1, No. 15 unperforated roofing felt.

F. Cleaner: Liquid type, pH of 7 - 10.

G. Sealer: Colorless, non-yellowing, penetrating liquid type, pH of 7 -10; not detrimental to

terrazzo components.

H. Subfloor Filler: Latex type.

2.3 MIXES

A. Underbed: Comply with NTMA Guide Specification for terrazzo type indicated for component proportions and mixing.

B. Floor: Comply with NTMA Guide Specification for terrazzo type indicated for matrix and marble-chip proportions and mixing.
1. Color and Pattern: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are ready to receive Work.

3.2 PREPARATION

A. Clean substrate of foreign matter.

B. Remove loose or flaking concrete and repair to form sound, solid substrate.

3.3 INSTALLATION

A. Sand Cushion Terrazzo:
1. Place sand cover over structural floor substrate to nominal thickness of 1/8 inch and roll smooth.
2. Place slip sheet over sand bed surface, lapping edges and ends 2 inches.
3. Place cementitious underbed over slip sheet to nominal thickness of 2-1/2 inches. Broom finish top surface.
4. Place reinforcement in center third of underbed. Stop reinforcement at joints in underbed, holding back approximately 1 inch from joint. Lap reinforcement joints 3 inches minimum.
5. Locate divider and control joint strips to form panels of 25 sq ft maximum or as indicated on Drawings. Insert in semi-plastic uncured underbed. Install straight and level.
6. Place terrazzo topping mix over prepared underbed to nominal thickness of 1/2 inch.

B. Curing:
1. Begin curing procedures as soon as curing materials can be applied without damaging formed surfaces.
2. Use curing method in accordance with NTMA instructions.
3. Close area to construction traffic, allowing undisturbed curing.

C. Surface Finishing:
1. Brush apply terrazzo topping mix slurry to topping surface.
2. Finish terrazzo in accordance with NTMA instructions.
3. Produce terrazzo finish surface to match approved sample, with minimum 70 percent chip exposed.
4. Grind terrazzo surface with power disc machine; successively sequence using coarse to fine grit abrasive, using wet or dry method.
5. Apply grout mix matching matrix color to fill honeycomb exposed during grinding.
6. After grout has sufficiently cured, grind repaired areas using fine grit abrasive.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Scrub and clean terrazzo surfaces with cleaner in accordance with NTMA instructions. Let dry.

C. Immediately after terrazzo has dried, apply sealer in accordance with NTMA instructions and let dry.

D. Seal and polish surfaces in accordance with NTMA instructions.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over finished terrazzo surfaces.

END OF SECTION

SECTION 09 66 68 - DANCE FLOORING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor retarder over existing concrete substrate.
2. Factory fabricated floating resilient dance floor system.
3. Resilient transition strips.
4. ADA-approved floor transition strips where flooring system interfaces with adjacent finishes.

B. Related Sections:
1. Section 03 30 00 – Cast-in-Place Concrete: Flooring susbstate.
2. Section 09 65 00 – Resilient Flooring and Base: Continuous coved rubber base.

1.2 REFERENCES

A. ASTM E648 (NFPA 253) - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 PERFORMANCE REQUIREMENTS

A. DIN Certification: Furnish wood athletic floor system meeting DIN 18032-2 criteria for shock absorption, deflection, area of deflection, rolling load and surface friction.

B. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
1. Indicate floor joint pattern and termination details.
2. Indicate ramping and solid curbing where necessary to meet ADA requirements for adjacent finish floor level offsets.

C. Product Data - Submit manufacturer’s printed data for the following:
1. Flooring panel and performance surfacing data.
2. Manufacturer's Installation Instructions: Submit standard and special installation procedures, perimeter conditions requiring special attention, and. Include manufacturer's recommendations for accessory products.
3. Vapor retarder data.

D. Samples:
1. Submit sample of panel construction with specified performance surfacing, nominal 12 x 12 inches in size.
2. Submit full-size sample of resilient pads.

E. Certifications:
1. Manufacturer's certification that floor system meets or exceeds DIN 18032-2 requirements.
2. Manufacturer's current certification that proposed installer is approved by the manufacturer for the specific installation.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, suggested schedule for cleaning and maintaining of performance surfacing.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

B. Installer: Company specializing in performing work of this section with minimum five years' experience and approved by system manufacturer for the specific installation.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Review installation procedures including procedures for acclimation of flooring panels.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install flooring system until wet construction work is complete and ambient air at installation space has moisture content stabilized between 35 and 50 percent and temperature is stabilized between 65 and 80 degrees F.
   1. Do not install flooring system until materials have been acclimated to ambient temperature and humidity conditions for minimum of 48 hours. Unroll materials and allow to relax to flat condition prior to beginning installation.

C. Provide heat, light, and ventilation prior to installation.

D. Maintain room temperature and humidity for minimum period of two days prior to delivery of materials to installation space, during installation, and continuously after installation.

PART 2 - PRODUCTS

2.1 RESILIENT DANCE FLOORING SYSTEM

A. Manufacturers:
   1. Harlequin, www.harlequinfloors.com
   2. O'Mara Sprung Floors, www.sprungfloors.com
   3. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Basis-of-Design: *Activity with Vinyl Surface* sprung floor *triple sandwich* floating system as manufactured by Harlequin or approved equivalent by specified manufacturer.

2.2 COMPONENTS

A. System Description – Permanently installed fully-floating system over depressed concrete floor slab:
   1. Vapor retarder membrane, ASTM D 4397, polyethylene sheet not less than 6-mils thick..
   2. Dual layer, multi-density cellular polyurethane.
   3. Lower semi-flexible suspension panel.
   4. Top semi-flexible suspension panel.
   5. Specified vinyl performance surface.
   6. Total System Weight: Nominal 40 lbs/sq.yd.
   7. Total System Thickness: 2-1/8" (verify with manufacturer for slab depression).
   8. Average Shock Absorption: 59.4%.

B. Flooring Fasteners: Not applicable.

C. Vinyl Performance Surface:
1. *Cascade* homogeneous PVC with slip-resistant embossed surface and mineral fiber reinforcement as manufactured by Harlequin.
2. Thickness: Minimum 0.080” (2mm).
3. Weight: 4.8 lbs./sq. yd.
4. Roll Width: 78.8”.
5. Fire Rating: Class 1 per ASTM E648.
6. Color: Selected by the Architect from manufacturer’s standards.

2.3 ACCESSORIES

A. Resilient Base: Provided under Section 09 65 00. Color as selected by the Architect.

B. Ramp and Solid Curbing: System manufacturer’s solid curbing and floor-offset ramps where indicated. Provide with specified performance surfacing.

PART 3 - EXECUTION

3.1 EXAMINATION and PREPARATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify ambient temperature and relative humidity levels are in accordance with system manufacturer’s recommendations and these specifications and ensure that fabricated panels have been acclimated within the area of installation as specified.

C. Subflooring:
1. Broom clean and prepare existing concrete substrate to receive flooring system in accordance with manufacturer's instructions.
2. Place vapor retarder over subfloor surface, lapping edges and ends minimum 6-inches and sealing all seams and perimeter with plastic tape.

3.2 INSTALLATION

A. General:
1. Install system in strict accordance with manufacturer’s printed instructions, the Project Drawings, these Specifications, and the approved submittal(s).
2. Use no applied adhesive or fasteners unless approved by the manufacturer for the particular installation and as indicated in the approved submittal(s).
3. Butt all joints together tightly in hairline appearance and hold with manufacturer’s double-sided continuous tape on backside of joints.
4. Provide 1/4-inch expansion space at perimeter walls and other flooring interruptions.
5. Provide matching ramps as indicated at floor offsets, with slopes meeting ADA requirements.

B. Transition Strips: Install resilient tapered or flat transition strip(s) at interfaces of differing floor materials. Tapering and heights of transition strips shall meet ADA requirements.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on floor after installation until Owner acceptance.

C. Maintain finish manufacturer’s recommended temperature and humidity levels until Owner acceptance.

D. Where additional construction activities cannot be avoided after completed flooring installation, protect installed flooring with sheets of hardboard on kraft paper, or double layer of sound-deadening felt with edges lapped and taped.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean finished floor surfaces in accordance with manufacturer's instructions just prior to Owner acceptance.

END OF SECTION

SECTION 09 68 13 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fully-adhered broadloom and walk-off carpet as scheduled and specified.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Subfloor at carpeted areas.
2. Section 09 65 00 - Resilient Flooring and Base: Rubber base at carpeted areas.

1.2 REFERENCES

A. Consumer Products Safety Commission:
1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.

B. National Fire Protection Association:
1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of joints, direction of carpet pile, patterns and colors, and location of edge moldings.

C. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples:
1. Submit two carpet tiles illustrating color and pattern design for each type and color of carpet selected.
2. Submit two 12 inch long samples of transition edge strip and accessories.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, including:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics:
1. Floor Finishes: Comply with one of the following:
a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
b. CPSC 16 CFR 1630.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing work of this section and is approved by manufacturer.
1. FCIB or IFCI certified carpet installers or demonstrate compliance with certification program requirements.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Store materials in area of installation for 48 hours prior to installation.

C. Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

D. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish additional 10% of each installed material type/color installed to Owner. Obtain receipt.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tarkett Johnsonite Floor Covering, www.commerical.tarkett.com
B. Substitutions: None.

2.2 COMPONENTS

A. Roll Carpet: 100 percent nylon, tufted textured loop on synthetic cushion backing.
1. Basis of design: Patterns and colors as scheduled; manufactured by Tarkett.
2. Construction: Tufted.
3. Primary Backing: Synthetic Non-Woven.
4. Secondary Backing: *Powerbond Cushion RS* cushion backing with manufacture's *Peel & Stick* installation.
5. Face Weight: 20 oz. per S.Y
6. Finished Pile Height: 0.080".
7. Fiber System: *Dynex*® Nylon.
8. Dye Method: Solution dyed/yarn dyed.
9. Stain Repel and Soil Release: Manufacturer's *Eco-Ensure (Fluorine-Free Soil Protection)* treatment.
10. Flammability: Class I per ASTM E662.

B. Walkoff Carpet: 100 percent nylon entry mat carpet with open-face construction by Tarkett .
1. Basis of design*:* Scheduled patterns/colors for *Abrasive Action II* .
2. Format type. Roll
3. Dye Method: Solution dyed.
4. Construction
a. Tufted, Accuweave Patterned Loop
b. Primary Backing: Synthetic Non-Woven and manufacturer's *Powerbond Cushion*.
5. Pile height: 0.185".

C. Manufacturer's Warranties:
1. Lifetime antimicrobial protection.
2. Lifetime anti-stain protection.
3. Lifetime edge ravel protection.
4. Lifetime face fiber wear.
5. Lifetime antistatic.
6. Lifetime cushion delamination and resiliency.

2.3 ACCESSORIES

A. Subfloor Filler: Self-leveling latex-modified cementitious type, ARDEX SD-F "Feather Finish" as manufactured by Ardex Engineered Cements.

B. Subfloor Primer: Compatible with carpet material and recommended by carpet manufacturer.

C. Moldings and Edge Strips: Extruded aluminum, clear anodized; height as required to protect carpet edge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are smooth and flat within tolerances specified in Section 03 30 00 and are ready to receive work.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
2. Arrange for the Owner's independent testing laboratory to perform calcium-chloride testing or deep-probe moisture meter testing per ASTM-F2170 for new and existing substrates for each area receiving the specified floor finish. Provide written test results to the Architect.
3. Subfloor finishes comply with requirements specified in Section 03 30 00 for slabs receiving carpet.
4. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with trowel-applied sub-floor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured

C. Clean subfloor and apply flooring manufacturer's recommended primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

D. Broom and vacuum clean primed subfloor immediately prior to installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET CARPET INSTALLATION

A. Primer: Apply primer to concrete substrate as recommended by manufacturer.

B. Carpet:

1. Verify carpet match before cutting to ensure minimal variation between dye lots.
2. Lay out carpet and locate seams in accordance with CRI 104 section 7.2:
   a. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   b. Do not locate seams perpendicular through door openings.
   c. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   d. Locate change of color or pattern between rooms under door centerline.
   e. Provide monolithic color, pattern, and texture match within each contiguous area.
3. Install carpet tight and flat on subfloor. Trim carpet neatly at walls and around interruptions.
4. Double cut carpet seams.
   a. Make cuts straight, true, and unfrayed.
   b. Apply a bead of carpet manufacturer's seam sealer to carpet edges at proper height to seal all edges. Thoroughly clean all seams. Ensure that seams are seam straight, not overlapped or peaked, and free of gaps.
   c. Roll with 100 lb. roller for complete contact of carpet backing to floor and with uniform appearance.
5. Complete installation of edge strips, concealing exposed edges.

3.4 WALKOFF CARPET INSTALLATION

A. Primer: Apply primer to concrete substrate as recommended by manufacturer.

B. Carpet:
1. Do not mix carpet from different cartons unless from same dye lot.
2. Cut carpet cleanly, fitting tight to intersection with vertical surfaces without gaps.
3. Adhere carpet using manufacturer's peel and stick self-adhesive backing or cold-applied latex adhesive, applied with recommended notched trowel.
4. Trim carpet tile neatly at walls and around interruptions.
5. Roll installed carpet with 100 lb. roller for complete contact of carpet backing to floor.
6. Complete installation of edge strips, concealing exposed edges.

3.5 CLEANING AND MANUFACTURER'S INSPECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive or seam sealant from floor, base, and wall surfaces without damage.

C. Replace any damaged or stained carpet that cannot be cleaned to the satisfaction of the Architect.

D. Thoroughly clean and vacuum all carpet surfaces.

E. Arrange for carpet manufacturer's local area representative to inspect the completed installation and provide written report to Architect indicating any deviations from the project specifications.

END OF SECTION

SECTION 09 77 00 - FIBERGLASS REINFORCED PLASTIC WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: FRP pre-laminated wall panels.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Include physical characteristics, installation methods for each different type of substrate, and maximum permissible moisture content of substrates.

C. Shop Drawings: Show location and extent of wall panels, panel terminations, installation details, and elevations showing nonstandard conditions.

D. Samples for Initial Selection: For initial selection of color, pattern and surface texture, provide the manufacturer's standard color chips consisting of actual sections of each FRP wall panel and vinyl plastic material required showing the full range of materials, colors, and textures available.

E. Samples for Verification: Provide the following samples for verification of compliance with requirements indicated. Prepare samples from the same material to be used in the Work.
1. 6-inch by 6-inch square samples of each wall panel material required for verification of color, pattern, and texture selected.
2. 12-inch long sample of each molding accessory.

F. Product Test Reports: From a qualified independent testing laboratory showing compliance of FRP wall panel materials with requirements indicated based on tests performed by the laboratory within the past five years.

G. Maintenance data for FRP wall panel material components for inclusion in the operating and maintenance manuals specified in Division 1.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has previously installed FRP wall panel materials similar in design and extent to the materials required on this Project.

B. Fire Performance Characteristics: Provide FRP wall panels that are identical to those tested in accordance with ASTM E 84 for the fire performance characteristics indicated below. Identify wall panel materials with appropriate markings from the testing and inspection organization.
1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

C. Single Source Responsibility: Obtain each color, texture, grade, finish, and type of FRP wall panel material from a single source with resources to provided products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original factory wrappings, clearly labeled with identification of manufacturer, brand name, lot number, quality or grade, and fire hazard classification.

B. Store materials inside in original undamaged packages in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Do not store rolled goods upright; lay flat, blocked off the ground to prevent sagging and warping.
1. Maintain room temperature within the storage area at not less than 70 deg F

during the period FRP wall panel and accessory materials are stored. Keep material out of direct sunlight to avoid surface distortion.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Do not install FRP wall panel material until the space to receive the wall panel material is enclosed and weatherproof. Do not install materials until the ambient temperature within the building is maintained and stabilized at not less than 70-deg F for not less than 72 hours prior to beginning of the installation.

1.6 SEQUENCING AND SCHEDULING

A. Schedule installation with other construction activities to minimize the possibility of damage and soiling during the remainder of the construction period.

1.7 MAINTENANCE

A. Maintenance Instructions: Provide the manufacturer's instructions for maintenance of installed work. Include recommended methods and frequency for maintaining materials in optimum condition under anticipated traffic and use conditions. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products:
1. Fire-X Glasbord, Kemlite Company, www.kemlite.com.
2. Substitutions: 01 16 00 - Product Requirements.

2.2 FRP WALL PANELS

A. Wall Panels: Provide manufacturer's standard FRP wall panels. Panels shall consist of 0.09-inch thick, textured, USDA approved panel.

B. Sheet Size: 4 by 10 feet, cut for 5 ft. high wainscot.

C. Colors and Textures of Plastic Material: Provide plastic material that matches color and texture indicated by reference to the manufacturer's standard color and texture designation.

D. Adhesive: Provide the type of adhesive recommended by the manufacturer for use with the wall panel material on the substrate indicated.

E. Trim: Provide extruded, impact-resistant, vinyl plastic trim members matching color of wall panel materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates scheduled to receive FRP wall panel materials for compliance with manufacturer's requirements and conditions affecting performance.
1. Wall surfaces to receive FRP wall panel materials shall be dry and free from dirt, grease, loose paint, and scale.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris, and loose particles. Provide skim coat over rough walls to smooth surface.

1. Complete all finishing operations, including painting, before beginning installation of FRP wall panel materials.
2. Test masonry and plaster substrates to receive FRP wall panel with an electronic moisture meter. Moisture content shall be within manufacturer's recommended limits.
3. Prime and seal substrates, if required, in accordance with the FRP wall panel material manufacturer's recommendations for the type of substrate.

3.3 INSTALLATION

A. General: Install FRP wall panel materials in accordance with manufacturer's recommendations using adhesive recommended for use over the substrate.
   1. Moldings: Furnish moldings for perimeter edging where indicated. Install moldings in the longest practical lengths. Tightly butt end joints and miter corners.
   2. Installation Type: full wall height, from top of wall base to 8 inches above ceiling.

3.4 CLEANING

A. General: Immediately upon completion of installation, clean FRP wall panels and accessories using a manufacturer's recommended cleaning agent. Clean moldings in accordance with the manufacturer's recommendations.

B. Remove excess adhesive, using methods and materials recommended by manufacturer.

C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

END OF SECTION

SECTION 09 77 23 – FABRIC WRAPPED ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fabric-wrapped acoustical wall panels, absorptive type for acoustical panels mounted below 9 ft. from finish floor level.
2. Fabric-wrapped impact resistant wall panels for acoustical panels mounted below 9 ft. from finish floor level.
3. Fabric-wrapped tackable wall panels for corridors, classrooms, job-built display cases, and other locations as may be indicated.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing layout and components, including details of hanging method for wall panels and suspension method for baffles, accessories. Identify each panel and baffle as to size, type, and fabric.

B. Product Data: Submit manufacturer's technical data for each type of acoustical panel and baffle required.

C. Submit manufacturer's standard size swatches of scheduled fabric for each type of panel and facing material required.

D. Certified Test Reports: Submit test data from an independent testing agency, acceptable to authorities having jurisdiction, evidencing that panel assemblies comply with requirements indicated for fire performance characteristics.

E. Certificates: Submit certificates from manufacturers of acoustical panels attesting that their products comply with specified requirements including those for fire performance characteristics.

1.3 QUALITY ASSURANCE:

A. Fire Performance Characteristics: Provide acoustical panels, with surface-burning characteristics as indicated below, which have been determined by testing assemblies of identical materials and construction according to ASTM E 84 by a testing organization acceptable to authorities having jurisdiction.
1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

1.4 PRODUCT HANDLING:

A. Protect acoustical wall panels from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until "wet work" such as concrete and plaster have been completed and cured to a condition of equilibrium.

1.5 PROJECT CONDITIONS:

A. Do not begin installation until spaces to receive acoustical panels have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.

1.6 EXTRA MATERIALS:

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels:

1. Fabrics: Furnish quantity of each fabric equal to 5.0 percent of each type of fabric installed.
2. Fabric shall be provided in continuous rolls, packaged for storage.

PART 2 - PRODUCTS

2.1 GENERAL

A. MANUFACTURERS: Subject to compliance with requirements, approved manufacturers include the following:
1. Acoustical Surfaces, Inc. www.soundsilencer.com
2. Conwed, Inc.
3. Decoustics. www.decoustics.com
4. Golterman & Sabo, www.golterman.com
5. Lamvin http://www.lamvin.com
6. MBI Products Company, www.mbiproducts.com
7. Wall Technology. www.walltechnology.com

2.2 FABRICATION - GENERAL:

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from wrinkles, sags, blisters, seams, adhesive or other foreign matter.
1. Fabricate back-mounted panels in factory to sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive wall panels.
2. Fabricate suspended baffles in factory to indicated sizes, complete with hanging system.
3. Each panel shall be faced with approved fabric bonded directly to the panel face and edges. Provide panels with flat, wrinkle-free surface, and tailored corners.

B. Provide panel manufacturer's accessories for securely mounting panels of type and size indicated to substrates provided and complying with the following requirements:
1. Provide manufacturer’s 2-part zee-clips with one part screw- fastened to back of panel and receiving part fastened to wall using appropriate anchoring. In addition provide heavy-duty Velcro anchoring to stabilize panel and provide resistance to removal.
2. Unless indicated otherwise, anchoring system shall be designed to hold back of panel within 1/4” of wall surface.

2.3 ACOUSTICAL WALL PANELS:

A. Sound Absorption Performance: Provide acoustical panels with noise reduction coefficients (NRC) indicated as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

B. Octave Band Center Frequencies (Hz)/Nominal Absorption Coefficient: Panels tested at 2” thick shall have the following nominal octave band absorption coefficients within a tolerance of plus or minus 5% when mounted directly on a hard surface:
125/0.40
250/0.98
500/1.00
1000/1.00
2000/1.00
4000/1.00

C. Back-Mounted Edge-Reinforced Acoustical Wall Panels: Manufacturers standard panel construction consisting of scheduled fabric laminated to front, edges and back border of molded glass fiber board core, with edges chemically hardened to a minimum depth of

1/8" to reinforce panel perimeter against warping and edge damage. structural framing using wood, plastic, or metal will not be accepted:

D. Basis of Design:
1. Typical Panels: Decoustics *Type AP2* for panels located above 9’-0” or approved equivalent by specified manufacturer or approved equivalent by specified manufacturer.
a. Core Density: 7 lbs. per cu. ft.
b. Panel Face Size: As indicated.
c. Panel Thickness: 2” and 4” thick as indicated in the drawings.
d. Edge Detail: Square, fabric wrapped.
e. Fabric: Maharam wall coverings www.mahram.com;
1) Weight: varies from 10.2 oz to 16.5 oz
2) Color(s) and pattern(s) as scheduled.
2. Impact-Resistant Wall Panels: Decoustics *Type HIR* for wall panels located at any height in a gymnasium, below 9’-0” in other parts of the building or identified on the drawings as “Impact-Resistant”.

a. Use for panels mounted with any portion of panel installed at a height of less than 9'-0" above finish floor.

b. Provide construction as specified above plus impact-resistant rigid fiberglass sheet laminated to front, edges, and back border of glass fiber board core.

2.4 TACKABLE WALL PANELS

A. Back-Mounted Edge-Reinforced Tack Panels: Manufacturers standard panel construction consisting of scheduled fabric laminated to front, edges and back border of molded glass fiber board core, with tackable facer, and chemically hardened edges to provide panel perimeter reinforced against warping and edge damage. Structural framing using wood, plastic, or metal will not be accepted.
1. Basis of Design: *Type H.I.R. #1, Tackable* panels as manufactured by Decoustics or approved equivalent by specified manufacturer.
2. Core Density: Minimum 7 lbs. per cu. ft.
3. Panel Face: Smooth high-density fiberglass facer for tackability.
4. Edges: Resin hardened.
5. Panel Thickness: 1” or as indicated in the drawings.
6. Edge Detail: Square unless otherwise indicated.
7. Fabric: Maharam wall coverings www.mahram.com.
1) Weight: varies from 10.2 oz to 16.5 oz
2) Color(s) and pattern(s) as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level, and in alignment with other panels,

1. Scribe to fit adjoining work accurately at borders and at penetrations.

2. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories as specified above.

3. Remove and replace panels which are damaged and are unacceptable to Architect.

END OF SECTION

SECTION 09 77 30 - CEMENTITIOUS WOOD FIBER ACOUSTIC WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Factory painted custom-shaped cementitious wood fiber acoustical wall-mounted panels with factory-applied furring and acoustical backing.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's technical data for each type of cementitious wood fiber panel required.

C. Maintenance Procedures: Submit recommended procedures for normal cleaning and removal of stains including precautions in use of cleaning materials that may be detrimental to surfaces.

D. Samples: Submit minimum 6” x 6” sample panel for each panel type, showing full range of exposed texture to be expected in completed work. Samples shall have 2 fabricated edges and corner as specified.

E. Test Reports and Certifications: Submit certified test reports from recognized test laboratories. Submit manufacture’s certificate that products meet or exceed specified requirements, including fire, smoke, and acoustical ratings.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide cementitious wood fiber panels, with surface-burning characteristics as indicated below, which have been determined by testing assemblies of identical materials and construction according to ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials by a testing organization acceptable to authorities having jurisdiction.
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 450 or less.

B. Acoustical Performance: Provide panels with acoustical ratings of minimum 0.75 per inch thickness.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect cementitious wood fiber panels from excessive moisture in shipment, storage, and handling.

   1. Deliver in unopened cartons and store in a dry place with adequate air circulation. Open cartons at each end during storage to stabilize moisture content and temperature.

   2. Do not deliver material to building until "wet work" such as concrete and plaster have been completed and cured to a condition of equilibrium.

   3. Protect panels from soiling and abrasion on surfaces that will be exposed to view in final construction. Discard damaged panels at time of installation

1.5 PROJECT CONDITIONS

A. Do not begin installation until spaces to receive cementitious wood fiber panels have been stored within the area of installation.

1. Maintain installation area at approximately the same humidity and temperature conditions as planned for occupancy at least 48 hours before beginning installation of panels.

2. During and after installation maintain temperature and humidity as recommended by panel manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong www.armstrongceilings.com**.**

B. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Basis of Design: Basis of Design: *Tectum DesignArt "Finale" direct-mount wall panels* as manufactured by Armstrong.

B. Cementitious Wood Fiber Panels: Manufacturer's standard precast panels composed of long, chemically-processed Aspen wood fibers bonded with inorganic hydraulic cement, pressure bonded with a uniform bottom face texture to provide shapes and sizes as required, with the following properties:
   1. Density: 30 to 45 lbs. per cu. ft. with maximum 10% moisture content; ASTM C 209.
   2. Fire Resistance: Tested and classified by UL for flame spread, fuel contribution and smoke classifications of not more than 25, 15 and 5, respectively; ASTM E 84.
   3. Cementitious wood fiber Absorption: NRC of 0.85 for 1-inch thickness.

C. Fabrication
   1. General: Factory-fabricate the panels to sizes and configurations indicated and as follows:
      a. 1-inch thick cementitious panels in configurations and sizes as indicated on the drawings.
      b. Exposed Edges: Long edges factory-beveled and painted. Short edges factory-squared and painted.
      c. Furring: Factory-applied 2" x 1" furring strips.
      d. Acoustical Backing: 1" mineral wool acoustical infill.
   2. Finish: Manufacturer's standard factory paint in standard or custom color(s).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cementitious wood fiber panels in locations indicated with vertical surfaces and edges plumb, top edges level, and in alignment with adjacent panels.

B. Comply with panel manufacturer's printed instructions for installation of panels.

1. Panels direct to Drywall: Use flat-head drywall screws, spacing as recommended by the manufacturer, but no less than 12" o.c. through gypsum board and into each metal stud. Set screw heads flush with panel face.

2. Panels direct to Concrete or Concrete Masonry Unit walls: Use flat-head Tek screws specifically designed for self-threading into concrete. Spacing as recommended by the manufacturer, but no less than 16" each way. Set screw heads flush with panel face.

3. Panels to Wood Furring: Use flat-head drywall screws, spacing as recommended by the manufacturer, but no less than 12" o.c. along each furring strip. Set screw heads flush with panel face.

4. Panels direct to Metal Deck: Use flat-head self-drilling screws specifically designed for self-threading into heavy-gauge sheet metal. Spacing as recommended by the

manufacturer, but no less than 16" each way. Set screw heads flush with panel face.

5. Other: Reference panel manufacturer’s recommendations.
6. All screw heads to be field painted to match panels using panel manufacturer’s provided matching paint.

C. Remove and replace panels which are damaged and are unacceptable to Architect.

3.2 CLEANING AND ADJUSTING

A. Clean exposed surfaces of panels and trim in accordance with manufacturer’s recommendations for cleaning.

B. Fill minor scratches or gouges and touch-up with matching paint.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints and other coatings.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
   2. It is the intent of this Section that all exterior and interior materials normally requiring finish paint, coating, or stain/finishing as determined by the Architect, will be painted, coated, or stain/finished under this Section except for specialty coatings and finishes specifically covered under other Sections.
   3. Where the Bidder is uncertain of whether a specific item is intended to be painted, coated, or stain/finished, contact the Architect during the Bidding period for clarification.

B. Related Sections include the following:
   1. Section 05 50 00 - Metal Fabrications: Shop primed items to remain exposed.
   2. Section: 06 10 53 - Miscellaneous Rough Carpentry: Wood furring, blocking, and shims.
   3. Section 09 21 16 - Gypsum Board Assemblies: Surface preparation of gypsum board.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items may include, but are not limited to, the following factory-finished components:
      a. Prefinished casework and millwork.
      b. Prefinished ceiling grids and tiles.
      c. Toilet compartment doors and partitions.
      d. Prefinished mechanical and electrical equipment, unless roof-top equipment visible from ground level.
      e. Light fixtures.
      f. Hardware.

   2. Finished metal surfaces including the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper and copper alloys.
      e. Bronze and brass.

   3. Operating parts include moving parts of operating equipment and the following:
      a. Valve and damper operators.
      b. Linkages.
      c. Sensing devices.
      d. Motor and fan shafts.
      e. Electrical or control panels.

   4. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 REFERENCES

A. ASTM International:
1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM D3359 – Standard Test Method for Measuring Adhesion by Tape Test.

B. Painting and Decorating Contractors of America:
1. PDCA - Architectural Painting Specification Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit the following for each product specified; include primers and block fillers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Samples: For each color and material to be applied, provide on-site samples that match color, finish, sheen and sheen of each existing painted surface to be matched. For any selected new non-matching colors provide actual painted color cards, nominal 6” x 6” square.

1.4 QUALITY ASSURANCE

A. Obtain primers and block fillers from the same manufacturer as the finish coats.

1.5 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this section on projects similar in materials, design, and extent to those of this project, and whose work has resulted in applications with successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence application to the following:
1. Do not apply finish coats until paintable sealant is applied.
2. Back prime wood trim before installation of trim.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for paints and coatings.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply an additional 1-gallon of each color, type, and sheen of paint used in the Project; store where directed.

C. Label each container with color, type, and texture in addition to manufacturer's label. Provide schedule showing location of each color.

PART 2 - PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers:
1. Glidden Professional, www.gliddenprofessional.com.
2. Benjamin Moore & Co. www.benjaminmoore.com
3. PPG Paints www.ppgpaints.com
4. Sherwin-Williams Co. (Sherwin-Williams). www.sherwin-williams.com
5. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

E. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

F. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

G. Colors: As indicated in the Color Schedule in the Drawings.

H. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

2.3 CONCRETE MASONRY UNIT BLOCK FILLERS:

A. Concrete Unit Masonry Block Filler: Factory-formulated latex block fillers.
1. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Metal Field Primers:
1. Factory-formulated metal primer for galvanized or bare metal without shop primer.
a. Sherwin-Williams; Pro-Cryl Universal Water Based Primer, B66 Series: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.
2. Field Welds in Galvanized Metal:
a. ZRC Worldwide “Galvilite” zinc-rich coating.

B. Shop Primers: Typically applied by steel or miscellaneous metals fabricator.
a. Verify compatibility of finish paint with shop-applied primers.
b. Reference Division 5 metals sections for special epoxy shop primers required at items specified or indicated to be shop primed and field painted with urethane alkyd enamel.
c. Reference Division 5 metals sections for items to receive zinc-rich primer.

C. Exterior Concrete and Masonry Primer: Factory-formulated masonry primer for exterior application:
1. Sherwin-Williams; Loxon Masonry Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils.

2.5 EXTERIOR FINISH COATS.

A. Urethane Alkyd Enamel: Factory-formulated full-gloss urethane alkyd enamel for exterior application.
1. Sherwin-Williams; Industrial Urethane Alkyd Enamel, B54E51: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.

B. Alkyd Enamel: Factory-formulated formulated full-gloss alkyd enamel for exterior application.
1. Sherwin-Williams; Industrial Enamel B-54WZ101: Applied at a dry film thickness of not less than 2.0 mils per coat.
2. Apply two (2) coats over specified primer.

C. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.
1. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series: Applied at a dry film thickness of not less than 1.5 mils.
2. Apply two (2) coats over specified primer.

D. Concrete Curb Enamel:
1. Sherwin-Williams; H&C Concrete Sealer Solid Color solvent-based flat enamel (fire lane curbs).
2. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.

2.6 INTERIOR PRIMERS: Over unpainted new surfaces.

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
1. Sherwin-Williams; Loxon Concrete & Masonry Primer, A24W8300: Applied at a dry film thickness of not less than 3.0 mils.

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Sherwin-Williams; Pro Mar 200 Zero VOC Latex Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.5 mils.

C. High Performance Gypsum Board Primer: Factory-formulated acrylic primer for application under epoxy finish coats.
1. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.0 mils.

D. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer for metal items not shop-primed.
1. Sherwin-Williams; Pro Cryl Universal Water Based Primer B66 series: Applied at a dry film thickness of 2.0 – 4.0 mils.

E. Interior Zinc-Coated Metal Primer: Factory-formulated metal primer for galvanized metals not shop primed.
1. Sherwin-Williams; Pro Cryl Universal Water Based Primer B66 series: Applied at a dry film thickness of 2.0 – 4.0 mils.

2.7 INTERIOR FINISH COATS:

A. Interior Low-VOC Latex Enamel: Factory-formulated acrylic-latex interior enamel.
1. Sherwin-Williams: Pro Mar 200 Zero VOC Latex Enamel: Applied at a dry film thickness of not less than 1.7 mils.
2. Provide Gloss, Semigloss, and Eggshell/Satin as required to match existing.
3. Apply two (2) coats over specified primer.

B. Interior Metal including Doors, and Frames:
1. Apply two (2) coats of Pro Industrial Zero VOC Acrylic Semi-Gloss, B66W651 over shop primer.

C. Interior Semigloss Epoxy: Factory-formulated, two-component, waterbased, catalyzed epoxy resin for high performance applications.
1. Sherwin-Williams: Waterbased Catalyzed Epoxy B70-200 Series.
2. Provide Gloss or Semigloss as required to match existing.
3. Apply 2 coats over specified primer.

D. Interior Semigloss Epoxy: Factory-formulated, two-component, waterbased, catalyzed epoxy resin for high performance applications.
1. Sherwin-Williams: Waterbased Catalyzed Epoxy B70-200 Series, semigloss.
2. Apply 2 coats over specified primer.

2.8 INTERIOR WOOD STAINS AND LACQUERS

A. 250 VOC Interior Wood Stain: Factory-formulated penetrating wood stain for interior application, 250 g/L VOC. Use where stain or color is specifically indicated, and verify with Architect.

1. Sherwin-Williams; Wood Classics Interior Oil Stain-250.

A. Interior Waterborne Polyurethane Varnish: Factory-formulated clear varnish, Gloss or Satin.

a. Sherwin-Williams; Wood Classics Waterborne Polyurethane Varnish, A68 Series: Applied at a dry film thickness of 0.8 - 1.0 mils per coat. Satin finish unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. It is the paint contractor’s responsibility to determine the type, sheen, and color of existing painted surfaces for matching, and apply only products that are compatible to existing and will provide proper adhesion to existing.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Wood: 15 percent, measured in accordance with ASTM D4442.
4. Concrete Floors: 8 percent.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted.

1. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
2. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime.

2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Concrete Floors to be Stained: Acid-etch or shot blast fully cured concrete floors scheduled to receive solid color stain.

a. Ensure that floor is porous, clean, dry and free of grease, oil and other contaminates that may negatively affect final finish.
b. Vacuum floor thoroughly and damp clean with sponge mop prior to application.
c. Prior to beginning stain application test for floor's ability to absorb drops of water within 20-30 seconds. Where water drops are not readily absorbed, provide additional mechanical re-surfacing.

4. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Back-prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

5. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 10/NACE No. 2.
   b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

6. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Previously Painted Surfaces: When painting over surfaces that have been previously painted, prepare surfaces in accordance with paint manufacturer's instructions, and verify with manufacturer that new coatings are compatible with the existing coatings.

1. For proper adhesion of new paint, all existing painted surfaces with any level of sheen must be sanded prior to applying new products, regardless of manufacturer's statements regarding whether sanding of existing paint products is needed.

2. Arrange for paint manufacturer's factory representative to perform adhesion testing of existing paint layer(s) in accordance with ASTM D3359 using approved cross cutting blade, flaking brush, and pressure-sensitive tape (PA-280630 manufactured by Interpolymer Group). Existing paint shall be considered as satisfactorily adhered to substrate with a test result of 4B or better (less than 5% removed by test).

3. Remove completely any loose, flaking, or non-adhering paint.
   Clean existing finishes of grease, oil, dust or other materials that may tend to adversely affect adhesion of new paint. Do not use cleaners that will leave a residue.

4. Remove by sanding any gloss or sheen on existing painted surfaces before application of paint. Remove all sanding dust. Application of a bonding primer is not a substitute for removal of sheen by sanding.

5. Apply an alkyd bonding primer to all prepared existing painted surfaces prior to application of new paint. Use manufacturer's recommended epoxy primer for new epoxy painting. Verify proper primer for the specific application with the finish paint manufacturer and submit to the Architect.

6. Where encountering existing no-sheen finishes primer may not be required if preparation of existing surfaces will produce sufficient bonding of new paint, as demonstrated to the Architect through industry standard adhesion testing.

B. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   a. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   b. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   c. Use only thinners approved by paint manufacturer and only within recommended limits.

C. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
   4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
   10. Sand lightly between each succeeding coat and clean with tack-cloth.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
   2. Omit primer over metal surfaces that have been shop primed and touchup painted.
   3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Uninsulated metal piping.
   2. Uninsulated plastic piping.
   3. Pipe hangers and supports.
   4. Tanks that do not have factory-applied final finishes.
   5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
   7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Switchgear.
   2. Panelboards.
   3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Stipple Enamel Finish (for drywall): Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Owner reserves the right to test installed work at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner will engage a qualified independent testing agency to sample paint material

being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

C. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 SCHEDULE - EXTERIOR SURFACES

A. Scheduling of paint types below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern

B. Concrete and Plaster (other than acrylic-finished plaster to remain unpainted):
1. Low-Luster Acrylic Finish: Two finish coats over specified primer.
a. Primer: Specified exterior concrete and masonry primer.
b. Finish Coats: Specified exterior low-luster acrylic paint.
2. Fire Lane Curbs and Other Curb Painting:
a. Primer: Not required.
b. Finish Coats: 2-coats specified fire lane curb paint.

C. Concrete Unit Masonry (standard CMU as used for backs of masonry site walls): Provide the following finish system over exterior concrete masonry:
1. Elastomeric Paint: Reference separate section number09 96 53
2. Two finish coats over specified block filler.
a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Elastomeric paint.

D. Metals: Provide the following finish systems over exterior galvanized or non-galvanized metal surfaces indicated to be painted:
1. Steel doors and frames, railings, steel masonry lintels, steel stairs:
a. Two coats specified urethane alkyd enamel over specified primer or shop primer.
2. Miscellaneous piping, bollards, equipment supports indicated to be painted and not scheduled as urethane alkyd:
a. Primer: Specified exterior metal primer.
b. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.
3. Field Welds and Cuts on Galvanized Metal: Apply 2-coats of specified zinc-rich coating over wire-brushed and cleaned galvanized metal.

3.8 SCHEDULE - INTERIOR SURFACES (EXCEPT EPOXY)

A. Scheduling of paint types below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern.

B. Concrete (other than concrete masonry units): Provide the following paint systems over interior concrete:
1. Primer: Specified interior concrete and masonry primer.
2. Finish Coats: Interior low-VOC acrylic enamel.
a. Semigloss finish in Classrooms and Laboratories.
b. Eggshell/satin finish elsewhere unless otherwise scheduled.

C. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry units, except where scheduled for epoxy:
1. Block Filler: Specified concrete unit masonry block filler.
2. Finish Coats: 2-coats specified interior low-VOC latex enamel.
a. Semigloss finish in Classrooms and Laboratories.
b. Eggshell/satin finish elsewhere unless otherwise scheduled.

D. Gypsum Board Partitions: Provide the following finish systems over interior gypsum board partitions:
1. Primer: Specified interior gypsum board primer.
2. Finish Coats: 2-coats specified interior low-VOC latex enamel.
a. Semigloss finish in classrooms, laboratory and prep.rooms, restrooms, custodial closets, wet areas.
b. Eggshell finish elsewhere unless otherwise scheduled.

E. Gypsum Board Ceilings and Furrings: Provide the following finish systems over interior gypsum board ceilings and furrings in dry or normal humidity areas:
1. Eggshell/Satin: Zero-VOC Latex Enamel Finish: Two finish coats over specified primer.
2. Primer: Interior gypsum board primer.
3. Finish Coats at typical dry or low humidity areas: 2-coats specified interior Eggshell/Satin low-VOC latex enamel.
4. Finish Coats in wet or high humidity areas: 2-coats specified interior Semigloss low-VOC latex enamel.

F. Metals: Provide the following finish systems over exterior galvanized or non-galvanized metal surfaces indicated to be painted:
1. Stair treads, risers, and stringers; railings and field-painted infill panels; other items specifically indicated for urethane alkyd enamel.
a. Two coats specified urethane alkyd enamel over specified primer or shop primer.
2. Miscellaneous piping, bollards, equipment supports; loose lintels.
a. Primer: Specified metal primer or shop primer.
b. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.
3. Field Welds and Cuts in Galvanized Metals: Apply 2-coats of specified zinc-rich coating over wire-brushed and cleaned galvanized metal.

G. Exposed roof structure and roof deck (including piping, conduit, etc.): provide the following finish systems:
1. Undercoat: Specified interior dryfall paint.
2. Finish coat: Specified interior dryfall paint.

3.9 SCHEDULE - INTERIOR EPOXY COATINGS

A. Scheduling of paint type below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern.

B. Concrete Unit Masonry or Concrete: Provide the following epoxy system over interior concrete masonry or rubbed concrete:

1. Semigloss Epoxy Finish: Two finish coats over specified primer.

a. Block Filler: Concrete unit masonry block filler.

b. Finish Coats: 2-coats specified interior water based semigloss epoxy finish.

C. Gypsum Board: Provide the following epoxy systems over interior gypsum board surfaces:
1. Semigloss Epoxy Finish: Two finish coats over specified primer.
a. Primer: Specified high performance gypsum board primer.
b. Finish Coats: 2-coats specified interior water based semigloss epoxy finish.

3.10 SCHEDULE - INTERIOR TRANSPARENT COATINGS

A. Transparent Finished Woodwork: Provide the following catalyzed lacquer system over wood surfaces:
1. Sanding: Completely remove all finish and stain from existing wood trim and sand smooth using 80-100-120 grit paper. Fill and sand smooth any wood damage that cannot be removed by sanding.
2. Stain Coat: Apply specified interior oil wood stain in number of coats as required to achieve approved uniform color.
3. Finish Coats: 2-coats specified interior polyurethane satin finish.
4. Lightly sand between all coats for best adhesion. Wipe with tack-cloth.

END OF SECTION

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Porcelain-faced marker boards.
   2. Vinyl-faced tackboards.
   3. Glass dry erase boards.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood grounds.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, and special anchor details and accessories.

C. Product Data: Submit data on each type of visual display surface specified.

D. Samples:
   1. Submit two panels, 8-1/2 x 11 inches in size, illustrating materials, colors, and finishes of each visual display system specified.
   2. Submit two 12” lengths of aluminum frames.

E. Manufacturer’s Certificates: Certify that vinyl tackboard coverings comply with surface burning characteristics specifies.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain all visual display surfaces from a single manufacturer.

B. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

C. Source Limitations: Obtain all visual display surfaces from a single manufacturer.

1.6 QUALIFICATIONS: Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish manufacturer's written ~~15-year~~ **50-year warranty for porcelain boards.**

C. Warranty: Include coverage of glass surface from discoloration or surface change.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Porcelain-Faced Boards
1. American Visual Display Products, LLP, www.americanvisualdisplay.com
2. Best-Rite Chalkboard Co. www.bestrite.com
3. Claridge Products and Equipment, Inc. www.claridgeproducts.com
4. General Binding Corporation, www.GBC.com
5. Lemco, Inc. www.adplemco.com
6. New Line Products www.newlineproduct.com.
7. Platinum Visual Systems www.pvsusa.com.
8. Substitutions: Section 01 60 00 - Product Requirements.

B. Glass Marker Boards: Clarus, www.Clarus.com

C. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Porcelain-Faced Boards: Balanced, high-pressure-laminated, magnetic markerboards of 3-ply construction consisting of porcelain enamel face sheet, core material, and backing.
1. Face Sheet: 0.024 inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.
a. Cover Coat: For porcelain-faced markerboards, provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.
b. Magnetic: Weight of lightweight magnets shall maintainable on board surface.
2. Core: 3/8 inch thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
1. Backing Sheet: 0.015-inch thick, aluminum-sheet backing.
2. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

B. Vinyl-Fabric-Faced Tackboards: Mildew-resistant, washable vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 oz./sq. yd., laminated to ¼-inch thick cork sheet.
1. Provide fabric with a flame-spread rating of 25 or less when tested according to ASTM E 84. Provide color and texture as scheduled or as selected from manufacturer's standards.
2. Backing for Fixed Boards: Factory laminate cork face sheet under pressure to 3/8-inch thick fiberboard backing.

C. Glass Boards:
1. Basis of Design: *Float + Depth Glass Marker Board* as manufactured by Clarus.
2. Material: 1/4" thick fully-tempered clear glass with back-color finish. System designed especially for use with dry markers.
3. Color(s): Selected by the Architect from manufacturer's standard colors.
4. Size: As indicated in the drawings.

5. Frame: Frameless with sanded edges and eased corners.
6. Hardware: Manufacturer's stainless steel stand-off 2-part mounting system.
    a. Provides nominal 1" gap between back of board and face of wall.
    b. Provide a minimum of (1) anchor at each corner of the predrilled board and (1) each at the mid-top and mid-bottom.
    c. Anchors shall be appropriate type for the substrate.

2.3 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch thick extruded aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure. Where tackboards are combined with magnetic markerboards, chalk trays and map rails shall be continuous across width of combination.
    1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
    2. Marker Tray: Manufacturer's standard, continuous, box-type, aluminum tray with slanted front and cast-aluminum end closures for each markerboard.
    3. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
        a. Display Rail: Provide continuous cork display rail, 2 inches wide, integral with map rail.
        b. End Stops: Provide one end stop at each end of map rail.
        c. Map Hooks: Provide 2 map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof. Provide a minimum of 6 map hooks per classroom.
        d. Flag Holder: Provide two flag holders for each room.
        e. Spring Clips: Provide 4 spring clips per each room.
        f. Roller Brackets: Provide 2 roller brackets per each room.
    4. Adhesives: Type used by manufacturer, waterproof.

2.4 FABRICATION

A. Magnetic Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
    1. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide a continuous, uniform writing surface.
    2. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches in either direction of equal spacing. Allow 1/4-inch clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
        a. Up to 16 feet, 1 panel.
        b. More than 16 feet but less than 32 feet, 2 panels.

B. Assembly: Provide factory-assembled chalkboard and tackboard units, unless field-assembled units are required.
    1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
    2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.
    3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

1.2 FACTORY FINISHING

A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; white color.

B. Aluminum Frame, Chalk Rail, and Accessories: Class II clear anodized finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify internal wall blocking is ready to receive Work and positioning dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Deliver and install visual display boards completely assembled in one piece without joints.

B. Establish top of boards height(s) indicated on Drawings.

C. Secure units level and plumb.

D. Coordinate units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean units in accordance with manufacturer’s instructions.

END OF SECTION

SECTION 10 14 00 – ROOM IDENTIFICATION PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of signs:
   1. Custom Room Identification Plaques.

1.2 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
   1. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
   2. Shop drawings:
      a. Drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components.
      b. Schedule of signs with information about each individual sign furnished, including, but not limited to: door number, room name and number, sign type, sign text, and sign illustration graphics. Schedule shall be prepared by contractor or supplier; schedule will not be furnished by Architect. Provide message list for each sign required, including large-scale details of wording and lettering layout.

B. Samples for initial selection of color, pattern, and texture:
   1. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

C. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
   1. Cast Acrylic Sheet and Plastic Laminate: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.3 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

D. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Manufacturers of Room ID Plaques:
      a. ABC Architectural Signing System.
      b. Allenite www.allenitesigns.com
      c. Andco Industries Corp. www.andco.com
      d. APCO Graphics, Inc. www.apcoline.com
      e. Architectural Graphic Products
      f. ASI Sign Systems, Inc. www.asisign.com
      g. Bayuk Graphic Systems, Inc.
      h. Best Manufacturing Company www.bestsigns.com
      i. Charleston Industries, Inc. www.cisigns.com
      j. DGS Corp.
      k. Diskey Sign Corp. www.diskeysign.com
      l. Environmental Graphic Systems, Inc. www.egs-signs.com
      m. Modulex. www.modulex.com
      n. Mohawk Sign Systems www.mohawksign.com
      o. Poblocki & Sons, Inc. www.poblocki.com/home.html
      p. South Texas Graphic Specialties, Inc.
      q. Spanjer Brothers, Inc.
      r. The Supersine Company
      s. Vomar Products, Inc. www.vomarproducts.com

2.2 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
   1. Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested according to the requirements of ASTM D 1003.
   2. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

C. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 ROOM IDENTIFICATION PLAQUES

A. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

B. Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
   1. Edge Condition: Square, unless otherwise indicated.
   2. Corner Condition: Round corners, unless otherwise indicated.

C. Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process.

D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

1. Room Numbers, Symbols, and Restroom Copy: Matte finished acrylic, raised 1/32 inch in color contrasting the face laminate.

a. Characters and pictograms shall be chemically welded to the acrylic backing, through the face laminate, to ensure permanent adhesion.

b. Room numbers and restroom copy shall be accompanied by Grade ll Braille by means of “VisiTouch Duradot System” using glass or metallic Duradots of 0.059” surface diameter with body of sphere pressure secured below face laminate.

1) Braille shall be placed directly below the corresponding raised characters. If text is multi-lined, Braille is placed below entire text and separated 3/8” from any other tactile characters and 3/8” minimum from raised borders and decorative elements.

2) The shape of Braille characters shall be rounded.

3) A combination of upper and lower case letters shall be used. Uppercase letters shall be used only as the first letter of the first word of each sentence, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

c. Routed boxes or glued-on dots are not acceptable.

2. Restroom pictograms shall appear on a minimum 6” square, unobstructed field.

3. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks

a. Meet requirements of ADAAG Title lll-4.30, with a 70% or better contrast.

b. Panel Material: Matte-finished clear acrylic with opaque color coating subsurface applied.

c. Font: Sans-serif type as indicated:

1) The stroke width of the upper case “I” being 15% of the letter height or less.

2) The character width of the uppercase “O” is between 55% and 110% of the height of the corresponding uppercase “I”.

3) The stroke width corresponding “O” width minimum 55% of “I” height 15% or less At least 55% maximum 110% of “I” height of “I” Height but no more than 110% of the “I” height.

d. Tactile Copy:

1) Raised Copy Thickness: Not less than 1/32 inch.

2) Copy Height: Limited to between 5/8” and 2”. If separate visual characters are provided, raised characters can be 1/2” high and need not contrast with background.

3) The stroke width of the upper case “I” being 15% of the letter height or less.

4) The distance between characters shall be a minimum of 1/8” and a maximum of 4X the character’s stroke width. These distances are measured between the closest points of adjacent characters.

5) Spacing between lines of copy shall be a minimum of 135% and a maximum of 170% of the corresponding uppercase “I” height (measured from baseline to baseline).

4. Lower or secondary copy minimum 5/8” high incised Helvetica Medium, all caps, color paint-filled.

5. Subsurface Copy: Apply copy to the back face of clear acrylic sheet forming the panel face by process indicated to produce precisely formed opaque images free from rough edges.

a. Use reverse silk-screen process to print copy; overspray the copy with an opaque background color coating, OR:

b. Use Dupont Chromalin heat- and pressure-laminated photopolymer film system to form copy and background color.

E. Window Signs: Slotted signs open on both ends for insertion of Owner panel. Window shall be a non-glare acrylic window with an exposed color laminate behind in color.

F. Produce exterior-mounted plaques of solid acrylic.

2.4 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Plaques: Attach panel signs to wall surfaces using the methods indicated below:
1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
3. Shim Plate Mounting: Provide 1/8-inch-thick concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 21 13 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Phenolic-core urinal screens and overhead braced toilet compartments.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: Concealed wood framing and blocking for compartment support.
2. Section 10 28 00 - Toilet and Bath Accessories.

1.2 REFERENCES

A. ASTM International:
1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, and door swings.

C. Product Data: Submit data on panel construction and each type of hardware and accessory.

D. Samples: Submit two samples, 12 x 12 inch in size, illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Texas Accessibility Standards (TAS).

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with placement of support framing and anchors in wall and ceiling.

PART 2 - PRODUCTS

2.1 PHENOLIC-CORE TOILET COMPARTMENTS

A. Manufacturers:
1. Bobrick Washroom Equipment, www.bobrick.com
2. Capitol Partitions Inc. www.capitolpartitions.com
3. PSISC (Columbia Partitions), www.psisc.com.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Floor mounted and overhead braced.

2.2 COMPONENTS

A. Door, Panel and Pilaster Construction: Solid phenolic-core panel material with plastic facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges.
   1. Facing Sheet Color: Laminate manufacturer and color as indicated.
   2. Core Color: Manufacturer's standard dark color or face color throughout.
   3. Fabricated Thickness:
      a. Doors and Pilasters: Minimum 3/4” solid.
      b. Stall Divider Panels and Urinal Screens: Minimum 1/2” solid.

B. Urinal Screens: Wall-mounted and floor-braced, of same material as toilet compartments.

2.3 ACCESSORIES

A. Pilaster Shoe: Formed stainless steel sheet, ASTM A666 Type 304, with No. 4 finish, 3-inch high, concealing floor fastenings.

B. Head Rails: Hollow extruded aluminum tube with anti-grip profile and cast socket wall brackets; clear anodized finish.

C. Brackets: Polished stainless steel, full-height (continuous) type.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware: Stainless steel:
   1. Full length piano hinge, self-closing, adjustable to hold door open at any angle up to 90 degrees.
   2. Heavy-duty stainless steel sliding-type door latch with brushed finish; at compartments indicated to be handicapped accessible, provide latches that comply with accessibility requirements of authorities having jurisdiction.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one for each compartment, mounted on doors of regular compartments and pilasters adjacent to doors at handicapped compartments.
   5. Furnish door pull and rubber-tipped bumper for out-swinging doors. Provide pulls on both sides of doors at compartments indicated to be handicapped accessible.
   6. Furnish continuous channel brackets at walls.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Doors:
   1. Standard Compartments: Provide 24-inch wide in-swinging doors unless indicated otherwise.
   2. Handicapped Accessible Compartments: Provide 3-inch wide out-swinging doors with a minimum 32-inch wide clear opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field measurements are as indicated on shop drawings.

C. Verify correct spacing of plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Maintain the following maximum clearances:
   1. Walls and panels: 1-inch.
   2. Walls and pilasters: 1-inch.
   3. Panels and pilasters: 1/2-inch.

B. Attach continuous panel brackets securely to walls using anchor devices.

C. Secure pilasters to floor; level, plumb, and tighten.

D. Secure continuous head rail to each pilaster with not less than two fasteners.

E. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

F. Urinal Screens: Attach to floors and walls with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Position: 1/4-inch.

C. Maximum Variation From Plumb: 1/8-inch.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

C. Adjust hinges to position doors in partially opened position when unlatched. Return out-swinging doors to closed position.

D. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. The following items are Contractor furnished and Contractor installed (CFCI):
   1. Grab bars.
   2. Stainless steel framed mirrors.
   3. Mop and broom holders.

B. The following items are Owner-Furnished and Contractor Installed (OFCI):
   1. Paper towel dispensers/disposal units.
   2. Toilet tissue dispensers.
   3. Soap Dispensers.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

B. Product Data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.

C. Schedule: Indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

D. Setting Drawings: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

1.3 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.4 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.5 WARRANTY

Provide Contractor’s written warranty against defects in materials and installation for a period of 1-year after Date of Substantial Completion of the Project.

Provide manufacturer’s written warranty against defects in materials or workmanship for a period of 3-years after Date of Substantial Completion of the Project. Defects shall include, but not be limited to: deterioration of finish, noisy operation or other operational problems, failure to meet specified quality assurance requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS FOR PRODUCTS PROVIDED AND INSTALLED BY CONTRACTOR:

A. Subject to compliance with specified requirements, provide toilet and shower accessories by one of the following:

1. A & J Washroom Accessories www.ajwashroom.com
2. American Specialties, Inc. www.americanspecialties.com
3. Bobrick Washroom Equipment, Inc. www.bobrick.com
4. Bradley Corporation www.bradleycorp.com

2.2 GENERAL REQUIREMENTS:

A. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed. Where manufacturer's fastening system is exposed fasteners, provide tamper-proof head design.

B. Except where specifically specified otherwise, provide all accessory items by same manufacturer for those items available by the same manufacturer.

C. Keys: Provide universal keying for access to all keyed toilet accessory units provided by the same manufacturer. Provide minimum of six (6) copies of key to Owner's representative and obtain receipt.

2.3 GRAB BARS

A. Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gage and as follows:
   1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
   2. Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.
   3. Gripping Surfaces: Smooth, satin finish.
   4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
   5. Configurations: As indicated in the drawings.
      a. Length: 42", at sides of water closet; 36", behind water closet.
      b. Shower "L": "L" style 18" x 30".
      c. Shower "U": "L" style 36" x 48" x 36".
   6. Provide manufacturer's concealed fastening system with anchors appropriate for the wall construction.

B. Basis-of-Design: Model B-6806 as manufactured by Bobrick.

2.4 FRAMED MIRRORS

A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes of not less than 18 gage, with square corners mitered, welded, and ground smooth. Meet requirements of ASTM C1036 Standard Specification for Flat Glass.
   1. Provide in No. 4 satin finish.
   2. Provide 24" wide x 36" high unless indicated otherwise.
   3. Provide manufacturer's concealed fastening system with anchors appropriate for the wall construction.

B. Basis of Design: Model B-290 as manufactured by Bobrick

2.5 CUSTODIAL MOP AND BROOM HOLDER

A. Type: Surface-mounted 18-gage Type 304 stainless steel "hat" channel with spring-loaded rubber cam-type mop/broom holders.
   1. Length: 34-inches.
   2. Integral stainless steel utility shelf.
   3. Complete with 4 hooks and 3 mop holders.
   4. Basis-of-Design: Bobrick B-239 x 34.

2.6 FABRICATION

A. General: Only a maximum 1-1/2 inch diameter, unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent accumulation of moisture. Provide galvanized steel backing sheet, not less than 22 gage and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theft-proof installation including heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring special tool to remove.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units in accordance with manufacturers' instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.

C. Install grab bars to resist tensile and moment forces generated by a load of 250 lb. applied in any direction, or as otherwise required by authorities having jurisdiction, whichever is more stringent.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

3.3 KEY TESTING AND DELIVERY

A. Test each key for proper operation of locking units. Group and package master keys and copies by manufacturer clearly marked as to manufacturer and the units key copies will fit. One master key and its copies will fit all lockable units supplied by that manufacturer.

B. Deliver marked key packages to Owner’s representative and obtain receipt.

END OF SECTION

SECTION 10 28 10 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous specialties, including:
   1. Wall corner guards.
   2. Suspended projector mount.
   3. Closet shelf bracket and rod.

B. For installation use only personnel who are skilled in the work required.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each miscellaneous specialty and accessory specified.

C. Installation Instructions: Submit manufacturer's recommended installation instructions showing all requirements for blocking and bracing.

D. Samples: Submit samples of each finish material exposed to view, 6 x 6 inches in size, showing full range of colors and patterns.

E. Shop drawings: Show location and extent of miscellaneous specialty items. Include plans, elevations, large-scale details of anchorages, and accessory items. Indicate typical and special details.
   1. Changing Station: Provide drawings prepared by manufacturer showing location of steel support members within wall cavity for full support of changing station.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protection: Protect specialties before, during and after installation. Protect installed work of other trades.

C. Replacements: In event of damage, make necessary replacements.

PART 2 - PRODUCTS

2.1 WALL CORNER GUARDS

A. **CG-1:**

B. **CG-2:** 16-ga. brushed finish Type 304 stainless steel, surface-mount type. Type AG-16-2 as manufactured by Korogard or approved equivalent by Boss
   1. Size: 2" x 2" x 4ft. one-piece length from top of floor base.
   2. Material: 16 ga. #4 satin finish stainless steel.
   3. Concealed Anchoring: Use clear structural silicone adhesive for full adherence to substrate.
   4. Provide at outside corners of drywall construction as indicated.

2.2 SUSPENDED PROJECTOR MOUNTS

A. Universal Leg Type Projector Ceiling Mount #PM-3 as provided by www.videomountstore.com.
   1. Load capacity 75 lbs. Provide with 1-1/2" diameter steel suspension pipe, length as necessary to reach overhead building structure.

2. Black powder coat finish.
3. Cable Lock: Kensington MicroSaver Lock for Projectors. 6-ft. x 6mm thick steel composite cable with carbon tempered steel core.
4. Ceiling finishing ring kit for 1-1/2” diameter suspension pipe.

2.3 CLOSET SHELF BRACKET AND ROD

A. Bracket:#1191 Regular Duty Adjustable Rod & Shelf Brackets, as manufactured by Knape & Vogt.
1. 14-gauge steel construction.
2. For 1.375” O.D. max. closet rod.
3. Color: Factory painted white.

B. Rod:
1. #750-5 Round Tubing, as manufactured by Knape & Vogt.
2. Outside Dimension: 1-5/16”.
3. Wall Thickness: 0.109”.
4. Material: Chromed steel.
5. Provide with #732 Tubing End Caps.

PART 3 – PRODUCTS

3.1 PREPARATION

A. Review manufacturer’s installation instructions and notify Architect in the event of discrepancies or incompatibility with existing conditions; do not proceed with installation until all such discrepancies have been resolved.

B. Ensure that solid wood blocking for wall-mounted items is properly installed and sufficient to support the maximum rated loads.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and with requirements of authorities having jurisdiction.

B. Anchor specialties securely in place in accordance with manufacturer’s instructions.

C. Sequence installation to accommodate required utility connections.

D. Touch-up surfaces damaged during installation. Replace damaged components that cannot be satisfactorily repaired.

3.3 CLEANING

A. Reference Section 01 71 00 – Execution and Closeout Requirements: Final cleaning.

B. Remove packing material from miscellaneous specialties and leave in clean condition, ready for operation.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Portable fire extinguishers, cabinets, and wall-mounting brackets.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking and shims.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.

B. Underwriters Laboratories Inc.:
   1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide fire rated cabinets classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each product specified, submit operational features, color and finish, and anchorage details.
   1. Fire extinguishers: Include rating and classification.
   2. Cabinets: Include rough-in dimensions, mounting details, door hardware, cabinet type, and trim style.

C. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers, fire blankets, and cabinets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Extinguishers, Cabinets, and Brackets:
   1. JL Industries, www.jlindustries.com.
   2. Kidde, www.kidde.com.
   3. Larsen’s Manufacturing Co., www.larsensmfg.com.
   4. Potter Roemer, www.potterroemer.com.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Multipurpose Dry Chemical Type: Cast steel tank with pressure gage; 4-A:60-B:C, 10-lb capacity.

2.3 FIRE EXTINGUISHER CABINETS

A. Size: To accommodate 10-lb multipurpose dry chemical type extinguisher.

B. Tub: Formed sheet steel, 0.036-inch thick base metal.

C. Doors and Trim: Formed stainless steel sheet.

D. Configuration: Semi-recessed type, sized to accommodate extinguisher.

E. Trim Type: Rolled-edge trim, returned to wall surface, with 4-inch projection or less.

F. Door: 0.016-inch thick, full-glazed panel, reinforced for flatness and rigidity; with minimum 1/2 inch thick frame.

G. Door Glazing: Glass, clear, 1/8-inch thick tempered.

H. Door Hardware: Manufacturer's standard door-operating hardware with either lever handle and cam-action latch or door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

I. Cabinet Mounting Hardware: Appropriate to cabinet.

J. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim in one piece with corners mitered, welded, and ground smooth.

K. Pre-drill for anchors.

L. Weld, fill, and grind components smooth.

M. Glaze doors with resilient channel gasket glazing.

N. Finishing Tub and Interior: Baked enamel, color as selected.

O. Finishing Doors and Trim: No. 4 polished stainless steel.

2.4 FIRE-RATED FIRE EXTINGUISHER CABINETS

A. Where cabinets are indicated to be installed in fire-rated CMU walls, provided cabinets listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall.

B. Match construction of non-rated cabinets except as follows:
1. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch thick, cold-rolled steel sheet lined with minimum 5/8 inch thick fire-barrier material.
2. Provide factory-drilled mounting holes.

2.5 ACCESSORIES

A. Extinguisher Brackets: Formed steel, plated or baked enamel finish.
1. Furnish brackets for extinguishers mounted inside cabinets.
2. Furnish brackets for extinguishers not mounted inside cabinets.

B. Cabinet Signage: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
a. Application Process: Vinyl letters.
b. Lettering Color: White.
c. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install cabinets plumb and level in wall openings.

B. Install wall brackets to walls and cabinets at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Secure rigidly in place.

D. Place extinguishers on wall brackets.

E. Position cabinet signage as required by authorities having jurisdiction.

END OF SECTION

SECTION 10 56 13 - METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Metal storage shelving units.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate shelving locations and configurations; show installation details at special or non-standard conditions.

C. Product Data: Submit for each type of metal shelving unit specified, including physical characteristics, durability and resistance to fading.

D. Samples: Submit two samples, minimum 6 x 6 inches in size, of each color and finish specified.

E. Manufacturer's Installation Instructions: Submit installation instructions for each type of substrate encountered.

1.3 QUALITY ASSURANCE

A. Provide all metal shelving units by a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product warranties and product bonds.

B. Accept metal storage shelving on site. Inspect on arrival for damage.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Sequence metal storage shelving installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and the Manufacturer, agreeing to repair or replace shelving units which fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
   1. Warranty Period: 2-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL STORAGE SHELVING

A. Manufacturers:
   1. Acme Visible Records www.acmevisible.com
   2. ASI Storage Solutions www.asilockers.com
   3. Dixie Shelving www.dixieshelving.com
   4. E S Steel Equipment Co Inc.
   5. E-Z Shelving Inc. www.e-zshelving.com
   6. Hi-Line Storage Systems Co. www.hi-line.com
   7. Lyon Metal Products, Inc. www.lyon-metal.com
   8. Penco Products Inc. www.pencoproducts.com
   9. Republic Storage Systems www.republicstorage.com
   10. Shelving Solutions, LLC www.shelvingsolutions.com
   11. Spacesaver Corp. www.spacesaver.com

12. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Sheet Steel: Mild, cold rolled and leveled unfinished steel; minimum 18 gage thick; provide higher gage where indicated to provide appropriate loading capacity.

B. Shelving Units: Heavy-duty open shelving units consisting of four upright corner pilasters, 13-gage thick, slotted to receive clips clipped together with shelves as indicated. Provide 2 pairs of side sway braces and one pair of back sway braces per unit. Shelves adjustable 1-1/2 inches on center.
1. Size: 36 inches wide x nominal 85 inches high x 18 inches deep unless indicated otherwise.
2. Number of Shelves: Seven, including fixed bottom and top shelves.

C. Load Capacities: Minimum load capacity for each shelf shall be as follows:
1. For units up to 36" wide: Minimum 400 lbs. per shelf.
2. For units 42” to 48” wide: Minimum 425 lbs. per shelf.

2.3 SHOP FINISHING: Steel: Manufacturer’s standard baked enamel finish, color as selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Inspect areas and conditions in which metal storage shelving will be installed. Verify locations of power feeds, positioning of exits and aisle ways and overall dimensions of space, including height and HVAC venting.

C. Verify that metal shelving components, including size and finish, are as specified before beginning assembly or installation.

3.2 PREPARATION

A. Vacuum floor surface to remove dust, debris and loose particles. Wet-mop, dry, and finish buff resilient flooring.

3.3 INSTALLATION

A. Install metal storage shelving after finishing operations, including painting, have been completed. Install system to comply with final layout drawings, in accordance with manufacturer’s instructions. Position units level, plumb, and at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation.

B. Secure units to walls in accordance with manufacturer’s printed instructions using fasteners appropriate for the wall construction. For stud walls, fasteners must penetrate metal studs.

C. Bolt adjacent shelving units together to form single unit.

D. Field touch-up blemishes to original finish.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean steel surfaces in accordance with manufacturer’s instructions.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit finished shelving units to be exposed to continued construction activity.

END OF SECTION

SECTION 11 43 55 – COMMERCIAL ICE MACHINES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Self-contained ice machine cuber with built-in storage bin

B. Related Work Described Elsewhere: Utility hook-up to equipment is described in Plumbing and Electrical Sections of these Specifications; cooperate as necessary with all other trades to ensure proper and adequate provision for the required utility sizing and locations.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the ice machine manufacturer for both installation and maintenance of appliances required for this Project.

B. Retain paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Revise below to identify specific proprietary system or indicate on Drawings. Correlate with Division 1 requirements.

C. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of residential appliances and are based on the specific types and models indicated. Other manufacturers' appliances with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

D. Electrical Appliances: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. UL and NEMA Compliance: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.

F. AGA and ANSI Standards: Provide gas-burning appliances that carry the design certification seal of AGA and that comply with ANSI Z21-Series standards.

G. AHAM Standards: Provide appliances that comply with the following AHAM standards:
   1. Refrigerators and Freezers: Total volume and shelf area ratings certified according to ANSI/AHAM HRF-1.

H. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the Federal Trade Commission.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each ice machine, indicating product specifications and options

C. Operation and Maintenance Instructions: For each ice machine.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver appliances only after utility rough-in is complete and construction in the spaces to receive appliances is substantially complete and ready for installation.

C. Protect ice machines before, during, and after installation, including the installed work and materials of all other trades.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 WARRANTY

A. Section 01 70 00 - Execution and Closeout requirements: Product warranties and product bonds.

B. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ICE MACHINES

A. Manufacturers:
1. Hoshizaki Ice Machines, www.hoshizakiamerica.com.
2. Substitutions: Not allowed.

2.2 SELF-CONTAINED UNIT

A. Type: Model ***KM-201 BAH*** air-cooled self-contained *Crescent Cuber* unit as manufactured by Hoshizaki America, Inc.
1. Production: 201 lbs/day @ 70^0 F ambient air temperature and 70^0 F and 0^0 F water-in temperature.
2. Storage: Up to 80 lbs capacity.
3. Cabinet Finish: Stainless steel.
4. Ice Shape: Individual crescent cube, nominal 1-1/8” x 1-1/2” x 1/2”.
5. Dimensions: Nominal 24” W x 28” D x 39” H (including 6” legs).
6. Electrical Characteristics: 115V, 60 cycles, single phase, 6.1 Amps. Maximum breaker size 15 Amps.
7. Stainless steel evaporator.
8. Provide and install with in-line *Ametek STX 102-DPS* dual filter assembly with changeable cartridges.
9. Removable air filter.
10. Manufacturer’s Warranty
    a. 3-years parts and labor on entire machine.
    b. 5-years parts and labor on evaporator.
    c. 5 years parts on compressor and air-cooled condenser coil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review manufacturer’s installation instructions and notify Architect in the event of discrepancies; do not proceed with installation until all such discrepancies have been resolved.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and with requirements of authorities having jurisdiction.

B. Anchor equipment securely in place in accordance with manufacturer’s instructions.

C. Sequence installation to accommodate required utility connections.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Test each appliance to verify proper operation. Make necessary adjustments.

C. Verify that accessories required have been furnished and installed.

3.4 CLEANING

A. Section 01 71 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove packing material from ice machines and leave units in clean condition, ready for operation.

END OF SECTION

SECTION 11 61 33 – THEATRICAL RIGGING S STEMS

PART 1 - GENERAL

1.1 SECTION SUMMAR

A. This specification describes the installation of the theatrical rigging equipment and stage drapery tracks at the Auditorium Stage and Black Box.

1.2 RELATED DOCUMENTS

A. Theatre Rigging Drawings (“TR” Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

1.3 RELATED WORK

A. Section 11 61 43: Stage Draperies.

B. Section 11 61 62: Theatrical Lighting Systems.

C. Section 27 41 15: Audio-Visual Systems and Equipment.

D. Division 26: Electrical Work.

1.4 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:

1. American Iron and Steel Institute (AISI),
2. American National Safety Institute (ANSI),
3. American Society of Mechanical Engineers (ASME),
4. American Society of Testing and Materials (ASTM),
5. National Electrical Manufacturer’s Association (NEMA),
6. Occupational Safety and Health Administration (OHSA),
7. Underwriters Laboratories (UL),
8. Entertainment Services and Technology Association (ESTA)
9. Entertainment Technicians Certification Program (ETCP)

1.5 DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the Theatrical Rigging Systems. Refer to the Theatre Rigging Systems (TR Series) drawings for further information relating to this Section.

B. Demolition: Auditorium Stage

1. Demount and remove all stage drapery and track hardware from the overhead rigging battens and store or dispose of in accordance with Owner’s requirements.
2. Demount and remove motor control cabinet, fire curtain control panel and remote rigging controller and dispose of in accordance with Owner’s requirements.

C. Rigging System: Auditorium Stage

1. The existing Auditorium stage rigging consists of a series of overhead battens suspended from both motorized, electronically controlled hoisting system and dead-hung types as described on the drawings.

a. Provide new automated electronic control system designed and installed to allow operation of the existing motorized hoisted line sets. The hoist control system will include distributed motor control

components, a rigging control console, associated electrical cabling, conduit, raceways, and junction boxes as required to interconnect and operate the rigging hoists. Hoist control shall include an operator panel located adjacent to the stage manager's panel as located on the drawings.

b. Hoist motors shall be operated via wall-mounted rigging control panel (RCP) allowing hoist selection, run-stop positional control, hoist status display, and emergency stop (ESTOP) functions.

2. Replace all existing batten termination connections for overstage hoisted and dead-hung rigging linesets.
3. Provide required ANSI standard signage adjacent to each new motorized rigging control location.

D. Fire Safety Curtain System: Auditorium Stage

1. The existing Auditorium stage rigging includes a braille lift type motorized fire safety curtain system as described on the drawings.
2. Provide new automated electronic control system designed and installed to allow non-emergency operation of the existing motorized fire safety curtain. The hoist control system will include distributed motor control components, a rigging control console, associated electrical cabling, conduit, raceways, and junction boxes as required to interconnect and operate the fire safety curtains. Hoist control shall include an operator panel located adjacent to the stage manager's panel as located on the drawings.
3. Provide new electronic emergency release connection in conjunction with the building fire detection/alarm system.

E. Draperies & Hardware: Auditorium Stage

1. Drapery for the stage platform shall consist of a main curtain with matching valence, masking legs and borders, a mid-stage act curtain, an upstage blackout curtain, cyclorama and tab masking at either side of the stage.
2. Drapery and associated hardware on the auditorium shall mount on utility hoist or dead-hung battens as described in the drawing.

a. The main curtain, mid-stage act curtain, and blackout curtain, each consisting of two (2) matched fabric panels, will part at their centers and draw open on a traveler track. The draw mechanism will be hand operated utilizing a sandbag weighted tension block for the operating line. The main curtain shall fully clear the proscenium when opened.
b. The masking legs and tabs shall be track mounted; operation will be by hand using walk-along track hardware.
c. Valence, borders, scrim, and the cyclorama will be fixed and tie directly to hoisted utility battens.

F. Draperies & Hardware: Black Box

1. Curtain Tracks

a. Provide walk along tracks to support a series of new black velour masking panels conceal the walls within the room as described and scheduled on the drawings.

G. General Requirements

1. Each rigging component must include the quantity of wire rope lift lines, trim chains, compression sleeve fittings, pipe or truss batten sections, and all necessary hardware for a fully operable rigging system.
2. Adhere to and provide all needed repairs, inspections, and services as noted in the warranty portion of this specification.

1.6 RESPONSIBILIT AND RELATED WORK

A. The drawings included with this specification convey general system concepts. The plans do not show complete and accurate building details. The Installer is responsible for making the field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems. Coordinate the work with the General, Electrical and other related contractors as stated in Part 1.4, and the scheduled work of other trades.

B. Conduit infrastructure system, including wire for AC Power and grounding for the Theatre Rigging Systems, shall be provided as part of the contract. Coordination between different disciplines is required to achieve a

proper conduit system installation and power provisions for Theatre Rigging Systems. The electrical installation shall be in accordance with division 26 and the National Electric Code.

C. Verify the requirements and integrate components of the theatre lighting power and control system mounted to rigging hardware.

D. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

E. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply systems in full working order. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

F. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner including any associated charges or fees.

G. Execute all work in accordance with all Standard Authorities listed above, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

1.7 QUALIT ASSURANCE

A. Contractor’s Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:

1. No less than five years’ experience with equipment and systems of the specified types under the same business name.
2. Experience with at least five projects of comparable scale within the last two years.
3. Employ only fully trained stage riggers and mechanics for the erection of the stage equipment.
4. All theatrical rigging activity shall be supervised by an ETCP certified theatre rigger.
5. The stage riggers will be completely familiar with the type of equipment to be installed. A competent and knowledgeable Job Superintendent will be on the job at all times when work is in progress.
6. Maintain a fully staffed and equipped service facility.
7. Contractor shall attend pre-installation meetings to coordinate with other trades as required.

1.8 PRE-INSTALLATION SUBMITTALS:

A. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the installer above 25% of the scheduled value of this work until all submittal information has been approved. Cost for the Owner's consultant to review secondary and re-submittals due to the Installer's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Installer. The cost shall be based on the hourly rates of the Architect and consultants as published in their current professional fees schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost-plus ten percent (10%).

B. Project Submittal Part 1:

1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:

a. Section 1: A complete schedule of submittals.
b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.

C. Project Submittal Part 2:

1. Provide for approval no later than sixty (60) days after issuance of notice to proceed and in accordance with previously submitted submittal schedule.

    a. Section 1: Complete list of products to be incorporated within the Work.
    b. Section 2: Manufacturer's data sheets for each product. Provide original manufacturer's data sheets in order as they appear in the specification. These data sheets are submitted for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
    c. Section 3: Fabric Samples. Submit a sample book of each fabric specified, containing manufacturer's standard colors available in the quality of fabric specified for the Owner's selection and approval of color. More than one color may be selected. After selection, upon request, submit one square foot sample of each fabric in each color for final review.
    d. Section 4: Submit Material Safety Data Sheets (MSDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the MSDS.

2. Drawings:

    a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drawing (CAD) system compatible with AutoCAD release 2013. Electronic files of theatrical rigging contract documents shall not be distributed for use in generating submittal documents with the exception of architectural backgrounds.
    b. Drawings depicting attachment of equipment to structure or mechanical assemblies that support overhead loads must show the work has been reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
    c. Installation Drawings. Provide drawings showing special details depicting methods and means specific to each product and each product manufacturer's recommended installation methods and means. Provide assembly and attachment for each product. Drawings should be reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
    d. Schematic Drawings. Provide drawings detailing inter-component and intra-component, on Theatrical Rigging Installer assembled components or fabricated products.
    e. Conduit and Electrical Drawings. If the system incorporates an electrical or electronic system of any type, provide floor plan drawings, including all walls, doors and rooms, showing exact power requirements and conduit routing for each system with the location of all junction boxes, terminations, etc.
    f. Equipment Drawings. Provide equipment mounting and location details including necessary physical dimensions, clearances, load limits, etc.
    g. Software diagrams showing the hierarchical structure of operator screens and functions with sample screen shots.
    h. Floor plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on floor plans and/or sections such as guide wires or tracks, loft blocks, battens, etc.
    i. Custom Enclosures and Millwork Drawings. If custom enclosures or millwork is required, provide full fabrication detail drawings indicating size, material, finish and openings for equipment.
    j. Fabricated Plates, Panels, or Signage Drawings. If plates, panels, or signage is required, provide complete drawings depicting dimensioned locations of components, component types, engraving or printing information, plate material and color, and bill of material.
    k. Labeling Drawing. Provide representative equipment labeling scheme of locking rail, loading rail, etc.
    l. General Detail Drawings. Provide detail drawings depicting any unique installation methods specific to each product.
    m. Any other pertinent data generated which is necessary to provide the Work.

D. Submittal Format:

1. Electronic submission of submittals is required. Where non- electronic submittals shall be bound in a three-ring D style binder sized for 150% of the material with a maximum size being a three inch spine. Use multiple volumes if necessary.
2. Provide each submittal with a unique number and be numbered in consecutive order.
3. Provide each submittal binder with a cover and a spine reflecting the project title and submittal number.
4. Provide each submittal with a complete table of contents with the following information:

    a. Project title and number.

b. Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
c. Date of submission.
d. Referenced addendum or change-order number as applicable.
e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
f. Index Product Data sheets by manufacturer and model or part number.

5. Separate major grouping with labeled binder tabs.
6. Arrange product data list in alpha-numeric order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
7. Drawings executed at an appropriate scale, not smaller than ⅛” 1’-0” for conduit/floor plans, ¼” 1’-0” for equipment layouts, and ½” 1’-0” for mounting details and plate/panel details.

E. Submittal Copies:

1. These requirements represent minimum project requirements; a project’s general conditions may require additional copies for project distribution.
2. Electronic submission of submittals is encouraged. Where non-electronic documents are required, submit all documents electronically in PDF format.
3. Where hardcopy submittals may be required,

a. Submit (3) bound prints of all drawings.

4. Submit (3) copies of bound materials (e.g. product data.)

a. Submit (2) sets of any product or sample finishes as required within this specification.

F. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.

G. Approval of Submittals: The submittal information will be reviewed by the general contractor, owner, Architects, engineers, and consultant. Each submittal package will be returned, stamped as follows:

1. “No Exceptions Taken” proceed with construction, all job site coordination will be at the direction of the general contractor.
2. “Make Corrections Noted: No Resubmission Required” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
3. “Make Corrections Noted: Submit Corrected Copy” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
4. “REJECTED, Submit Specified Item” a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
5. “REJECTED, Revise and Re-submit” submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
6. “No Review Action Required” all information provided was for information or coordination purposes only. Review is not required.

1.9 PROJECT RECORD MANUAL

A. Submit three bound original sets (this is a minimum of two for the Owner and one for the Architect’s consultant; additional copies may be required by the project’s general conditions) after substantial completion and prior to final inspection.

B. The Project Record Manual shall be segregated into three separate bindings as follows:

1. Operations Manual:

    a. Product Data: Product actually incorporated within the Work:

        1) Manufacturer's data for each type of product conforming to the scheme above. The list shall include manufacturer's serial numbers.
        2) Owner/Instruction Manual for each product.
        3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
        4) Manufacturer's wiring diagram for each type of product actually incorporated.
        5) Separately bound list by manufacturer and model or part number of all products incorporated within the Work arranged in alphanumeric order.

    b. Record drawings: Final rendition of that specified depicting what is actually incorporated within the Work. Provide one (1) full size set and one (1) DVD-ROM containing all CAD generated drawings prepared in conjunction with this project. Drawing files to be in AutoCAD Release 2010 DWG format.
    c. Test Reports: Recorded findings of testing specification of this specification.
    d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.

        1) This procedure should describe the operation of all system capabilities.
        2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.

2. Service & Maintenance Manual:

    a. Provide an original copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
    b. Manufacturer's maintenance and care instructions.
    c. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
    d. Replacement parts list of all minor equipment such as fuses, lamps, connectors, knobs, etc.

3. Warranty Manual:

    a. Manufacturer's warranty statements on each product.
    b. Date of substantial completion and ending dates for warranties for each group of products.
    c. Software registration and licenses.

C. Include any other pertinent data generated during the Project or required for future service.

D. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.10 DELIVER , STORAGE, AND HANDLING

A. Ship product in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.12 FINAL INSPECTION AND TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Architect and/or Architect's Consultant no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for inspection and two (2) persons for testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components such as counterweights on arbors, adjustment of drapery tracks, etc.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:

1. Inspection of the methods and means employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each setting, and appropriately record these settings within the Record Documents.
4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at that time.

G. Rigging system installer shall return to the jobsite six months after acceptance to inspect the rigging hardware and attachments, curtain tracks, curtains, and battens.

1.13 WARRANT

A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost required to complete this warranty repair is the responsibility of the contractor.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty-four hours.

D. This warranty will include two (2) ANSI-compliant annual inspections. The first will occur 1-year after the project's substantial completion, and the second shall occur before the end of the two (2) year warranty. The inspection will be a level one inspection for all manually operated systems for year one and a level two inspection for year two. Both inspections will be a level two inspection for all motorized equipment. The Contractor shall provide the inspections at no additional cost to the Owner and at an agreed-upon time and date. The Contractor shall provide a full report with deficiencies or findings to the Owner and WJHW. All repairs covered by applicable warranties will be completed.

1.14 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide instruction to Owner and/or the Owner's designated personnel on the use, operation, maintenance and care of the System.

1. Develop training course based on the use of the System and manufacturers' recommendation. Provide (8) hours of training. The training period shall be divided into two segments and shall be scheduled at least two weeks apart. All training shall be scheduled at the convenience of the owner and designated personnel.
2. Submit an outline of the course with sample instructional aids for approval (30) days prior to scheduled instruction sessions.
3. If a representative of the manufacturer is used in the instructional course, the Contractor must be present throughout the extent of the course and ensure that the representative abides by the requirements set forth in these specifications.

B. Contractor shall be present at the first two (2) uses of the facility.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model name and number for manufacturers included in this specification are listed to establish a standard of product quality.

B. Substitution of specified products with other qualified manufacturers and products will be considered providing:

1. Proper substitution procedures outline under Division 1 is adhered to.
2. A request for substitution of each specific product must be made in writing by a bidding Contractor not less than ten (10) business days prior to bid for written approval of the Architect.
3. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.
4. Written permission is obtained for the substitution from the Owner or Owner's Representative.

C. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include a list of previously installed projects using proposed equipment that are similar in nature to specified System.

D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

2.2 GENERAL

A. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

2.3 CONTACTS

A. Listed below is contact information for Manufacturers of rigging components approved to provide equipment on this project. The below is not listed any preference or preferred order:

B. Automatic Devices Company

1. 2121 S. 12th Street, Allentown, PA. 18103
2. Telephone: (610) 797-6000
3. Approved to supply curtain track and curtain motors.

C. Crosby Group, Inc.

1. P.O. Box 3128, Tulsa, Oklahoma 74101
2. Telephone: (918) 834-4611
3. Approved to supply rigging hardware including chain, cable clips, cable, and anchor shackles.

D. Electronic Theatre Controls

1. 3031 Pleasant View Rd, PO Box 620979, Middleton WI 53562
2. Telephone (608) 831-4116
3. Approved to supply rigging hoists and controls.

E. IWeiss

1. 815 Fairview Avenue Suite 10, Fairview, New Jersey, 07022
2. Telephone: (201) 402-6500
3. Approved to supply rigging hardware, stage drapery, stage rigging loft/head blocks, and curtain tracks.

F. H&H Specialties

1. P.O. Box 9327, South El Monte, Calif. 91733
2. Telephone: (213) 283-3562
3. Approved to supply stage rigging loft/head blocks, curtain tracks, and curtain motors.

G. J.B. Martin

1. 445 rue St-Jean-sur-Richelieu, Quebec, Canada J3B 2M1
2. Telephone: (514) 346-6853
3. Approved to supply curtain fabric

H. K&M Fabrics

1. 2 Waco Street, Greenville, South Carolina 29611
2. Telephone: (800) 845-1896
3. Approved to supply curtain fabric.

I. Protech Theatrical Services

1. 3431 N Bruce Street. North Las Vegas, Nevada 89030
2. Telephone: (702) 639-0290
3. Approved to supply rigging hardware. stage drapery, stage rigging loft/head blocks, and curtain tracks.

J. Safety Technology International, Inc.

1. 2306 Airport Road, Waterford, MI 48327
2. Telephone: (248) 673 9898
3. Approved to supply polycarbonate device covers.

K. Texas Scenic Company

1. 8053 Potranco Rd, San Antonio, Texas 78251
2. Telephone: (210) 684-0091
3. Approved to supply rigging Hoists and controls, rigging hardware, stage drapery, fire curtain systems.

L. Thern, Inc.

1. 5712 Industrial Park Rd, Winona, Minnesota, 55987
2. Telephone: (800) 553-2204
3. Approved to supply stage rigging components, motorized hoists, hoist control, fire safety curtains and accessories, beam clamps, and associated hardware.

M. Ver Sales, Inc.

1. 2509 N. Naomi Street, Burbank, Ca. 91504
2. Telephone: (818) 567-3000
3. Approved to provide rigging hardware including chain and beam clamps.

N. Wenger (JR Clancy)

1. 7041 Interstate Island Road, Syracuse, N 13209
2. Telephone: (315) 451-3440
3. Approved to supply stage rigging components, motorized hoists, hoist control, fire safety curtains and accessories, beam clamps, and associated hardware.

2.4 RIGGING HARDWARE

A. Batten Assembly

1. Pipe battens shall be constructed of new ASTM A53/A 1-1/2 nominal schedule 40 plain end steel pipe.
2. Battens exceeding one standard pipe length will be joined using an internal splicing sleeve. Splices must provide the same overall capacity, deflection, and strength to the pipe battens as an un-spliced span. Threaded couplers are not permitted.

    a. Splice sleeves shall be designed by the Manufacturer for the intended use. Splice sleeves will be a minimum of 18 in length with a minimum of 9 extending into each pipe batten.
    b. Sleeves will be machined to a diameter that will create a snug fit within the pipe battens.
    c. Splicing sleeves will be fastened to the pipe batten with pins or 3/8” diameter bolts. Locate at least two fasteners on each side of splice joint; alternate direction of fasteners at right angles to one another across the diameter of the pipe.

3. Any fasteners used on pipe battens must meet SAE grade 5, and be equipped with self-locking nuts.
4. Cover the end of each batten with a yellow or white closed end, soft vinyl safety cap at least 4 inches in length. Cap shall display linesets maximum capacity, and lineset number.

B. Batten Connections

1. Wire rope lift lines shall terminate directly to trim chains constructed of NACM chain certified by their manufacturer as suitable for the intended purpose.
2. Chain shall be □ diameter or larger, and of sufficient length to wrap one and one-half times around the pipe batten and return to the eye of the wire rope lift line.
3. One chain end shall be terminated directly to the wire-rope eye, the other end secured with a forged screw pin anchor shackle rated for the intended purpose. The screw pin shall be moused or seized to ensure the pin will not release.
4. Alternative designs for batten connection and trimming methods shall require approval as part of the submittal process.
5. Where a pipe clamp may be required on a batten, a wrap-around type clamp shall be provided. This clamp shall be secured to the pipe using SAE 5 grade bolts, washers, and self-locking nuts.
6. Acceptable products:

    a. Clancy Alpha Chain
    b. 7 mm (0.275″) Grade 63 alloy chain

C. Wire Rope Lift Lines

1. Provide lift lines and fittings appropriate for supporting the load requirements.
2. For utility and drapery sets:

    a. Lift lines shall be a minimum of $^{3}/_{16}$” diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 4200 lbs.

3. For shell and stage electric sets:

    a. Lift lines shall be a minimum of $^{1}/_{4}$” diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 7000 lbs.

4. All wire rope must be new; damaged or deformed cable may not be used.
5. Exposed ends of wire rope shall be cut cleanly, then seized.

D. Wire Rope Termination

1. To connecting hardware, form eyes around an appropriately sized thimble using copper Nicopress compression sleeves.
2. To cable drums: terminate the wire rope on the inside of the lifting drum using a Nicopress compression stop sleeve.
3. Supply and install compression sleeves or clips in size and quantity per guidelines set forth in the Wire Rope User's Manual, by its manufacturer's specifications, and in accordance with industry guidelines.

E. Rigging Accessories:

1. In certain instances special component parts, such as sheaves, idler blocks, extra lines, etc., will be necessary in order to provide a fully operable system. Where such requirements are necessary, furnish, install, and adjust these components comparable to the quality of the products listed in these specifications.
2. Acceptable manufacturers:

    a. H&H Specialties
    b. JR Clancy
    c. Crosby

2.5 HOIST CONTROL

A. Motor Control Cabinet (MCC)

1. Components for the operation of the hoists and curtain machines shall be housed in NEMA 12 enclosures as located on the drawings. All shall include

    a. branch circuit protection and through-door disconnect switches
    b. low voltage control power supplies
    c. braking resistors variable speed drives, motor starters, or reversing contactors
    d. E-Stop and limit control

2. Fixed speed panels shall include motor starters and/or reversing contactors.
3. The MCC shall house an Emergency Shutdown Switch (EStop) that will be clearly visible on the front of the enclosure. This switch will disconnect the main power source and will render the entire system inoperable.
4. Front display indicators shall be provided for status, which include:

    a. Power

B. Rigging Control Panel (RCP)

1. Primary operation of the hoists shall be by way of a rack-mounted control panel mounted within the Stage Manager's Panel (SMP) backstage.
2. The control panel shall allow the hoists to be operated locally; a secondary wired pendant controller shall allow a pre-selected hoist to be operated remotely.
3. The operating mode shall be selected by a three-position keyswitch with "Off / Local / Remote" settings.
4. The control mechanism shall limit operation to (4) hoists at any given time. The hoist to operate shall be selected by a selector switch on the rack panel. The operator will be required to stop the currently selected machine(s) before selecting another to run.
5. The RCP shall house a receptacle for an auxiliary handheld pushbutton operating pendant. The pendant shall allow the operator to move to within line of sight during operation. The pendant control mechanism shall limit operation to (1) hoists at any given time. The hoist to operate shall be selected by a toggle or switch on the rack panel. The operator will be required to stop the currently selected machine(s) before selecting another to run.
6. The panel will house an E-Stop ("Emergency Shutdown Switch") This switch shall be a red mushroom shaped button which must latched when pressed and use a turn and pull motion to release.
7. The operator will operate the selected hoist using one of two momentary illuminated pushbuttons labeled "UP" and "DOWN."

2.6 STAGE DRAPER TRACKS

A. Straight Draw Curtain Tracks

1. Provide and install the curtain tracks as located and configured on the drawings.
2. Track shall be constructed of 14 gauge galvanized steel, roll formed to a 2-⅝" W X 2-¾" H channel with continuous slot in bottom. Provide un-spliced lengths up to 26' in length.
3. Track must mount to pipe battens on spacing in accordance with the Manufacturer's requirements with two-piece hangers formed from 11 gauge steel.
4. Provide a minimum of 2'-0" overlap in the center. Separate tracks at center with two overlap clamps.
5. Install carrier stops with at each end of track.
6. Provide single carriers, spaced 12" on center, constructed of (2) nylon-tired ball bearing wheels fastened parallel to carrier body. Supply carriers with heavy duty hook, swivel eye, back pack attachments and trim chain for attachment of drapes. Install neoprene bumper between each carrier to reduce noise.
7. Provide back-pack accessories to allow curtain to draw open from trailing (offstage) end.
8. Provide master carriers with 4-wheel nylon-tired ball bearing assemblies with bodies formed from 11-gauge steel. Connect to operating line with two formed steel cord clamps attached to each body. Supply each master carrier with two heavy duty hooks, swivel eyes, and trim chains for attachment of leading edge of drape.
9. Single and double end pulleys will clamp securely to the underside of the track channel and will be equipped with 6" diameter Nylatron GS sheaves grooved for up to ½" hand line. Install (2) ⅝" sealed precision ball bearings in each sheave. Lock shaft to side plate on head end with 3/16" keeper pin to prevent rotation and install fine threaded nylon insert lock nut.
10. Dead end pulley shall be mounted at 45 degrees from the traveler tracks to reduce clearance required for pulley between pipe battens.
11. Provide a sand bag tension pulley for operation of hand line of the mid-stage traveler. Provide adequate quantity of sand for proper hand line operation.
12. When flown to low trim, sandbag should be at floor level.
13. Hand line shall be ½" diameter, stretch resistant rope with spun polyester outer jacket double braided over solid polyester core.
14. Hand line should be installed in a manner to minimize twisting of lines that interferes with operation.
15. Acceptable products:

    a. H&H Specialties series 400
    b. ADC series 280

B. Walk-along Curtain Tracks

1. Provide materials and the labor to install the curtain tracks as located and configured on the drawings.
2. Track shall be made of 6063-T5 aluminum, extruded into 2-½" I-beam with 1" wide top, intermediate and bottom flanges. Provide un-spliced lengths up to 24' in length.
3. Track must mount to pipe battens on spacing in accordance with the Manufacturer's requirements with two-piece hangers formed from 11-gauge steel.
4. Provide single carriers, spaced 12" on center, constructed of (2) Delrin wheels fastened parallel to formed steel carrier body. Supply carriers with swivel hook for attachment of drapes. Install Nylatron wear strips at contact points to act as a bumper between each carrier to reduce friction. Provide neoprene bumpers between each carrier to reduce noise.
5. Provide walk along handles attached to the master carriers for operation of the curtain.
6. Provide end stops at each end of the track.
7. Ensure that all steel components are zinc plated for corrosion resistance.
8. Provide all track and associated hardware factory coated BLACK
9. Acceptable products:

    a. H&H Specialties series 300
    b. ADC series 140

2.7 COMPLETED S STEM

A. General

1. All installation of stage rigging equipment shall be completed utilizing new materials, free from flaws and rust, and in good working order. The jobsite shall be cleaned of all packing materials, lubricants, metal shaving, miscellaneous hardware, and components not used in the installation.
2. All dimensions are to be field verified. Location and attachment of hardware and size of components shall be confirmed by the stage rigging installer.

3. All electrical power, outlets, related systems, and structural elements required to make the system fully functional are the responsibility of the contractor.
4. If components and hardware are not specifically specified or called out, it is the responsibility of the contractor to provide those components in order to provide a fully operational theatre rigging system.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. Mount equipment and enclosures plumb and level.

C. Permanently installed equipment to be firmly and safely held in place in accordance with specified safety factors and Federal and State codes and regulations.

D. Work shall be completed within industry guidelines, including, Entertainment Services and Technology Association (ESTA), OSHA, National Electric Code, American National Standards Institute, American Society for Testing and Materials, American Institute of Steel Construction, National Fire Protection Association, National Electrical Manufacturers Association, plus any or all local, governmental, or other applicable codes.

E. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the Contractor, in accordance with the accepted industry standards and guidelines in this section. In no way will the theatre rigging contractor be relieved of primary responsibility to provide a safe, fully functional system.

F. The mechanical fabrication and workmanship will incorporate the best practices for good fit and finish. There will not be any burrs or sharp edges to cause a hazard, nor will there be any sharp corners accessible to personnel.

G. All equipment will be installed based on the manufacturer's recommendations and for the use intended by the manufacturer.

H. All shop and field welding will meet the qualifications of the AISC manual and will be without spatter or other evidence of poor practices.

I. All finishes which are disturbed during shipping and installation will be touched up to match the original.

J. Materials will conform to the following ASTM standard specifications:

1. A-36 structural steel
2. A-36 steel plates and bars
3. A-47 malleable iron casting
4. A-48 gray iron casting
5. A-53 welded and seamless steel pipe
6. A-120 black and hot dipped zinc-coated steel pipe

K. In order to establish minimum standards of safety, the following factors will be used:

1. cables and fittings provide a minimum 8:1 design factor
2. cable bending ratio is 30 times the cable diameter
3. nuts and bolts use minimum SAE grade 5 (ASTM rating A-449)
4. thread pressure of
    a. 500 lb. for cast iron
    b. 1000 lb. for steel
    c. 1500 lb. for Nylatron
5. steel designed to 1/5 of yield
6. bearings are rated for two times the required load operating at full speed for 2000 hours.

3.2 INSTALLATION OF MOTORIZED RIGGING S STEM

A. All wire rope components will be installed so as to prevent abrasion or rubbing of the wire rope against any part of the building construction or other equipment.

B. Pulleys and sheaves will be aligned as to provide a maximum fleet angle of 1.5 degrees. Mule blocks, cable rollers, guides, and sag bars will be installed as required to provide proper alignment.

3.3 INSTALLATION OF STAGE DRAPES AND TRACKS

A. Install all tracks and hardware according to manufacturer’s recommendations.

B. Stage draperies shall be installed near the end of the installation when chances of damage from other work are reduced. Stage area shall be broom clean with no further construction taking place prior to installation.

C. After hanging stage draperies, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles will be allowed to fall out naturally.

3.4 LABELING OF EQUIPMENT

A. Mark and label each batten with its set number, load/arbor capacity, stage centerline, and lift line locations with appropriate paint.

B. Provide labels clearly indicating date of manufacture, cloth type, manufacturer's name and address, size (width and height using 3/4 minimum lettering), and Owner's designated inventory number (to be coordinated with Owner) will be sewn into the back (in most cases, upstage) side of the upper hem at both ends of each drape panel.

3.5 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the System ensure the following:

1. Products are installed in proper and safe manner according to manufacturer’s instructions.
2. Dusts, debris, solder splatter, etc. is removed.
3. Labeling has been provided.
4. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
5. Products are neat, clean and unmarred and parts securely attached.
6. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. Job site shall be left broom clean.

B. Provide two portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project.

1. Include rechargeable batteries and re-charger along with holster for wearing on belt.
2. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

END OF SECTION 11 61 33

SECTION 11 61 43 - STAGE DRAPERIES

PART 1 - GENERAL

1.1 SUMMAR

A. This specification describes the manufacture and installation of stage curtains in the Auditorium Stage and Black Box.

1.2 RELATED DOCUMENTS

A. Theatre Rigging Systems Drawings (“TR” Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

1.3 SECTION INCLUDES

A. Project instructions for the Contractor and System description details.

B. System product descriptions.

C. Project completion instructions for the Contractor.

1.4 RESPONSIBILIT AND RELATED WORK

A. Coordination, supply, installation, shipping, storage, inspection, commissioning, testing, instruction and warranties of the Stage Draperies.

B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and fully functioning System.

C. Also includes:

1. Required licenses and permits including payment of charges and fees.
2. Verification of dimensions and conditions at the job site.
3. Provision of submissions.
4. Installation in accordance with the Contract Documents, Manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
5. Extension of electrical service, including ground, to equipment locations.

D. The drawings included with this specification convey general system concepts. Where the plans do not show complete and accurate building details, the Contractor is responsible for making field measurements necessary to establish exact locations, relationships, and load capacities necessary for the installation of these systems.

E. Coordinate the work with the related documents and the scheduled work of other trades.

F. Supply accessories and minor equipment items needed for a complete and fully operational system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

G. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires the Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

H. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Architect.

I. Execute all work in accordance with all Standard Authorities listed above, and all applicable State and Local codes, ordinances, and regulations.

J. If a conflict develops between the Contract Documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

K. Flame proofing and Documentation of Drapery Fabrics:

1. Provide inherently flame retardant or chemically flame proofed draperies. Chemical flame proofing formula and process must adhere to Bureau of Standards U.S. Department of Commerce. Once fabric is processed, it will pass such tests as are required by the Fire Marshall of the local fire department, the Owner, and any other authority having jurisdiction.
2. A certificate for each drape is required to be provided to the Owner. This certificate clearly indicates: the name of the Stage Drapery (sub) Supplier, the name and color of the fabric, the name of the Company providing flame proofing treatment, date of the treatment, the date of re-treatment required, the name of the chemical and method used, the signature of an officer or approved representative of the Company providing flame proofing treatment, and the signature of an officer of the company installing the draperies. Official seal(s) and signature(s) of a notary public is required for the both signatures.
3. Labels clearly indicating date of manufacture, cloth type, manufacturer's name and address, size (width and height using 3/4 minimum lettering), and Owner's designated inventory number (to be coordinated with Owner) will be sewn into the back (in most cases, upstage) side of the upper hem at both ends of each drape panel.
4. Curtain must have NFPA 701 flameproof certification tag sewn on the bottom of each curtain panel for Fire Inspection reference. This label should have permanent stitching around all four sides.

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:

1. National Fire Protection Association (NFPA)
2. American National Standards Institute (ANSI)
3. American Society of Testing and Materials (ASTM)
4. Occupational Safety and Health Administration (OSHA)
5. Underwriters Laboratories (UL)
6. Entertainment Services and Technology Association (ESTA)
7. Entertainment Technicians Certification Program (ETCP)

1.6 DESCRIPTIONS AND REQUIREMENTS

A. Draperies & Hardware: Auditorium Stage

1. Provide new drapery for the stage platform that shall consist of a main curtain with matching valence, masking legs and borders, a mid-stage act curtain, an upstage blackout curtain, and cyclorama.
2. All drapery and associated hardware on the auditorium shall mount on existing battens or traveler track hardware as noted below:

a. The main curtain, mid-stage act curtain, and blackout curtain, each consisting of two (2) matched fabric panels, will part at their centers and draw open on a traveler track. The draw mechanism will be hand operated utilizing a sandbag weighted tension block for the operating line. The main curtain shall fully clear the proscenium when opened.
b. The masking legs shall be track mounted; operation will be by hand using walk-along track hardware.
c. Valence, borders, scrim, and the cyclorama will be fixed and tie directly to hoisted utility battens.

B. Draperies & Hardware: Black Box

1. Provide new walk-along tracks to support a series of new black velour masking panels to conceal the walls within the room as described and scheduled on the drawings.
2. New walk-along tracks shall mount to existing pipe grid structure.

C. General Requirements

1. Draperies shall be constructed of professional grade fabric intended for use as stage curtains. All draperies will be certified as flame retardant as a result of either their inherent characteristics or chemical treatment in accordance with the AHJ.
2. Adhere to and provide all needed repairs, inspections, and services as noted in the warranty portion of this specification.

1.7 QUALIT ASSURANCE

A. Contractor’s Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:

1. No less than five (5) years of experience with equipment and systems of the specified types.
2. Experience with at least five (5) comparable scale projects within the last two (2) years.
3. Employ only fully trained stage riggers and mechanics for the erection of the stage equipment.
4. An ETCP certified theatre rigger shall supervise all rigging installation.
5. The stage riggers will be completely familiar with the type of equipment to be installed. A competent and knowledgeable Job Superintendent will be on the job at al times when Work is in progress.
6. Maintain a fully staffed and equipped service facility.
7. At the request of the Architect, demonstrate that:

a. Adequate plant and equipment is available to complete the work.
b. Adequate staff with commensurate technical experience is available.

1.8 SUBMITTALS:

A. Provide submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures section unless otherwise indicated.

B. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work until all submittal information has been approved.

C. Submittals must be original work produced by the firm responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.

D. Project Submittal Part 1:

1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:

    a. Section 1: A complete schedule of submittals.
    b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.

E. Project Submittal Part 2

1. Provide for approval no later than sixty (60) days after issuance of Notice to Proceed and in accordance with previously provided submittal schedule.
2. Products:

    a. Section 1: Complete list of products to be incorporated within the Work (Bill of Materials).
    b. Section 2: Manufacturer's data sheets for each product.

        1) Provide original Manufacturer's data sheets in order as they appear in this specification.
        2) Data sheets are required for each product in sufficient detail to evaluate product suitability for incorporation within the Work.
        3) Product literature shall include documentation of UL listing or approved recognition by a Nationally Recognized Testing Laboratory (NRTL).

    c. Section 3: Fabric Samples

        1) Submit a sample book of each fabric specified, containing manufacturer's standard colors available in the quality of fabric specified for the Owner's selection and approval of color. More than one color may be selected. After selection, upon request, submit one square foot sample of each fabric in each color for final review.

    d. Section 4: Submit Safety Data Sheets (SDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the SDS.

3. Drawings:

    a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system. Electronic files of theatrical lighting contract documents shall not be distributed for use in generating submittal documents with the exception of Architectural backgrounds.
    b. Equipment Drawings:

        1) Provide complete assembly details of drapes including stitching schematics, weights, attachment details, and fabric/drape schedule.

    c. Installation Drawings.

        1) Provide detail drawings depicting any unique installation methods specific to each product.

4. Any other pertinent data generated which is necessary to provide the Work.

F. Submittal Format:

1. Electronic (PDF) submittal documents are required for review.
2. Provide each submittal with a unique number and each shall be numbered in consecutive order.
3. Submittals shall not be issued with other disciplines.
4. Provide each submittal with a complete table of contents with the following information:

    a. Project Name
    b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and shall be numbered in consecutive order.
    c. Date of submission.

d. Referenced specification Section, Part, Article, Paragraph, and page number or drawing reference as applicable.

5. Follow list by Manufacturer's data sheets, arranged as in Part 2 of this specification. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
6. Drawings executed at an appropriate scale, but not smaller than 1/8 1'-0" for conduit/floor plans, 1/4 = 1'-0" for equipment layouts, and 1/2" = 1'-0" for mounting details and panel details.

G. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review as directed.
2. Indicate any changes that have been made other than those requested.

H. Approval of Submittals: Each submittal package will be returned with one of the following stamps:

1. "No Exceptions Taken" proceed with construction; all job site coordination will be at the direction of the General Contractor.
2. "Make Corrections Noted: No Resubmission Required" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
3. "Make Corrections Noted: Submit Only Corrected Pages/Items" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
4. "REJECTED, Submit Specified Item" a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
5. "REJECTED, Revise and Re-submit" submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
6. "No Review Action Required" all information provided was for information or coordination purposes only. Review is not required.

1.9 PROJECT RECORD MANUAL

A. Provide electronic copies of the project record documents or as required per the General Conditions of the Project.

B. The Project Record Manual shall be segregated into three separate bindings as follows:

1. As-Built Record Documents:

a. Product Data:

1) List of all products incorporated in the Project inclusive of all substitutions, field changes, or revisions The list shall include Manufacturer's serial numbers.
2) Manufacturer's data for each type of product conforming to the scheme above.
3) Organize and bind the above in specification order.

b. Record drawings: Final rendition of project drawings enumerated in the Submittal section above. Provide editable computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system, in both a DWG and PDF file format.
c. Test Reports: Record findings of systems testing described in Part 3 below.

2. Operations Manual

a. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.

1) This procedure should describe the operation of all system capabilities.

2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.

3. Service & Maintenance Manual:

   a. Provide an original copy of the service manual on every piece of equipment for which the Manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
   b. Manufacturer's maintenance and care instructions.
   c. Maintenance Instructions: include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

4. Warranty Manual:

   a. Manufacturer's warranty statements on each product.
   b. Date of substantial completion and ending dates for warranties for each group of products.
   c. Software registration and licenses.

5. Drapery Flame proofing Documentation:

   a. Provide all certificates, test reports, and documentation required for drapery flame proofing.

6. Include any other pertinent data generated during the Project or required for future service.
7. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.10 DELIVER , STORAGE, AND HANDLING

A. Products shall ship and be stored in their original container to prevent damaging or entrance of foreign matter until installation.

B. Provide protective covering during construction to prevent damaging or entrance of foreign matter.

C. Replace, at no expense to the Owner, product damaged during storage, handling, or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.12 FINAL TESTING AND OBSERVATION

A. Upon completion of installation and initial tests and adjustments, described in Part 3, acceptance testing shall be performed by the Consultant.

B. The process of acceptance testing the System may necessitate moving and adjusting certain component parts, such as counterweights on arbors, adjustment of drapery tracks, etc. Perform such adjustments without claim for additional payment.

1.13 WARRANT

A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost associated with this warranty repair is the responsibility of the Contractor.

B. This warranty is in addition to any specific warranties issued by Manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Model numbers and manufacturers included in this specification are listed to establish a standard of function, performance, and quality.

B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure.

C. Providing product not specifically specified without prior written approval by the Owner, Architect and/or Architect's Consultant shall not be accepted.

2.2 GENERAL

A. Products shall be new, free from defects and listed by an NRTL when an applicable NRTL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptions below, provide product that meets or exceeds the specified product's published functionality.

2.3 CONTACTS

A. Listed below is contact information for Manufacturers of rigging components approved to provide equipment on this project:

1. K&M Fabrics

    a. 2 Waco Street, Greenville, South Carolina 29611
    b. Telephone: (800) 845-1896
    c. Approved to supply curtain fabric.

2. J.B. Martin

    a. 445 rue St-Jean-sur-Richelieu, Quebec, Canada J3B 2M1
    b. Telephone: (514) 346-6853
    c. Approved to supply curtain fabric

3. Rose Brand Fabrics

    a. 4 Emerson Lane, Secaucus, NJ 07094

b. Telephone: (800) 223-1624
c. Approved to supply drapery, hampers, and miscellaneous associated equipment.

4. Liba Fabrics Corp.

a. 132 W 36th St. 6th Floor, New ork, N 10018
b. Telephone: (212) 563-4991
c. Approved to supply curtain fabrics

2.4 STAGE DRAPER

A. General Specification for Stage Drapery

1. Provide and install all curtains as located and scheduled on the drawings.
2. Field verify all dimensions prior to fabrication of draperies.
3. Curtain fabric of professional grade fabric intended for stage use. If not inherently flame retardant, curtain fabric shall be chemically flame proofed at the mill using an immersion process. Flame proofing certificates for all fabrics used shall be furnished to the owner with the as-built drawings.
4. Sew tags identifying manufacturer and size of panel at each end of webbing at top and at one corner at hem in each drape.
5. Curtains must be constructed with vertical seams unless otherwise specified. The fabric grain shall run nap down and match in all panels. All panels must be un-spliced along their height.
6. Construction

a. Black Poly webbing at 3” wide shall be double stitched to the top of the curtain with 1” of face fabric turned under the webbing.
b. Brass rustproof grommets shall be inserted:

1) at the extreme top corners
2) in the pleat centers of curtains sewn with fullness, or
3) on 12” centers for flat curtains.

c. Grommet holes for track mounted curtains shall be supplied with

1) plated wire “S” hooks, or
2) snap hooks, sewn-in at the spacing noted above.

d. Drapery hung directly from an auxiliary batten shall have a 24” long black cotton tie line fastened in each grommet hole.
e. The centerline of the drape shall be marked on the top webbing with “CL” and a white tie line added to the corresponding grommet.
f. Curtains sewn with fullness shall have box pleats spaced 12” on center.
g. Bottom hems shall be 4” wide. These shall be sewn with a separate canvas chain pocket inside so that the bottom of the canvas pocket rides 2 inches above bottom of the hem. Provide #8 plated jack chain in the pocket.
h. All traveling curtains shall be sewn with a minimum 24” of face fabric turned back at the leading edge. All other vertical hems shall be 2”.

7. Use mercerized cotton thread, minimum weight of #16, color to match drape fabric.
8. Sew a 12” x 12” swatch of fabric near the lower offstage corner of each drapery for fire-resistance testing by the AHJ.
9. Fabric colors shall be as scheduled. Submit color sample card with submittal documents. Make all effort to ensure that curtains of the same color are fabricated from fabrics of the same dye lot.
10. Labeling

a. Sew labels onto the back (in most cases, upstage) side of the upper hem at both ends of each panel.
b. Curtain must have NFPA 701 flameproof certification tag sewn on the bottom of each curtain panel for Fire Inspection reference. This label should have permanent stitching around all four sides.
c. Labels shall clearly indicate

1) date of manufacture

2) cloth type
3) manufacturer's name and address
4) size (width and height using 3/4 minimum lettering
5) owner's designated inventory number

11. Basis of Design product:

a. For nominal 24-25 ounce fabric

1) KM Fabrics Charisma inherently flameproof velour.

b. For nominal 20-21 ounce fabric

1) KM Fabrics Crescent inherently flameproof velour

c. For cyclorama

1) Rose Brand Bleached white FR seamless muslin.

2.5 COMPLETED S STEM

A. General

1. All installation of stage rigging equipment shall be completed utilizing new materials, free from flaws and rust, and in good working order. The jobsite shall be cleaned of all packing materials, lubricants, metal shaving, miscellaneous hardware, and components not used in the installation.
2. All dimensions are to be field verified. Location and attachment of hardware and size of components shall be confirmed by the Contractor.
3. All electrical power, outlets, related systems, and structural elements required to make the system fully functional re the responsibility of the Contractor.
4. If components and hardware are not specifically specified or called out, it is the responsibility of the Contractor to provide those components in order to provide a fully operational theatrical rigging system.

B. Trimming/Leveling of Drapery

1. Contractor is to return to the jobsite within sixty (60) days, but not less than thirty (30) days of the installation to re-trim all tracks and curtains.
2. Provide documented notes on site visit to Architect and Architect’s Consultants on adjustments made during return visit.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. Mount equipment and enclosures plumb and level.

C. Permanently installed equipment to be firmly and safely held in place in accordance with specified safety factors and Federal and State codes and regulations.

D. Work should be completed within industry guidelines, including ESTA, OSHA, ANSI, ASTM, NFPA, plus any or all local, governmental, or other applicable codes.

E. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the Contractor, in accordance with the accepted industry standards and guidelines in this

section. In no way will the Contractor be relieved of primary responsibility to provide a safe, fully functional system.

F. The mechanical fabrication and workmanship will incorporate the best practices for good fit and finish. There will not be any burrs or sharp edges to cause a hazard nor will there be any sharp corners accessible to personnel.

G. All equipment will be installed based on the manufacturer's recommendations and for the use intended by the manufacturer.

H. All finishes which are disturbed during shipping and installation will be touched up to match the original.

3.2 INSTALLATION OF STAGE DRAPERIES AND TRACK HARDWARE

A. Install all track mounted draperies to hardware according to track manufacturer’s recommendations.

B. Stage draperies shall be installed near the end of the installation when chances of damage from other work are reduced. Stage area shall be broom clean with no further construction taking place prior to installation.

C. After hanging stage draperies, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles will be allowed to fall out naturally.

D. Verify that each drapery panel bears a label as described in paragraph 2.4., A, 9 above.

3.3 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Consultant.

B. Contractor will assist in this testing and provide all test equipment noted below.

1. Contractor shall provide at least one (1) person for inspection and two (2) persons for testing familiar with aspects of the System to assist the Consultant.
2. Contractor personnel shall be made available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications.
3. Testing process is estimated to take a minimum of one (1) day.

C. Testing will include operation of each major system and any other components deemed necessary.

D. The following procedures will be performed on each System:

1. Inspection of the means and methods employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the Manufacturer’s published specifications. Establish and mark normal settings for each setting, and appropriately record these settings within the Record Documents.
4. Other tests on equipment or systems deemed appropriate.

E. The Consultant will provide the Owner with a listing describing any incomplete or otherwise deficient items determined as part of the testing process. Where further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is complete.

F. Stage drapery installer shall return to the jobsite six months after acceptance to:

1. Inspect curtains and attachments
2. Re-trim all curtains.

3.4 INSTRUCTION OF OWNER PERSONNEL

A. Provide operations and service training on all equipment incorporated in the System.

B. Training shall not be conducted until final observation and testing is completed by the Consultant, unless otherwise directed by the Owner.

C. Provide (1) hour of training. Training shall be conducted in accordance with Owner's schedule.

D. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.

E. Submit an outline of the course with sample instructional aides for approval thirty (30) days prior to scheduled instruction sessions to architect and architect's consultant.

F. Following discussions with Owner, provide a Training submittal 2-4 weeks prior to first training. Submittal shall:

1. Indicate date, time, and approximate length of training session.
2. Indicate person(s) conducting training.
3. Indicate whether training will be video recorded.
4. Intended curriculum and most appropriate attendees (e.g., technician, operations, IT, etc.)
5. Include signature and title lines for:

    a. Owner acknowledging and accepting training schedule. Include both an Accepted and Rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
    b. Countersigning by trainer indicating that training actually occurred.
    c. All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
    d. Owner's representative attending training at the end of the session shall initial that:

        1) Training Occurred.
        2) Training Materials were provided and left with Owner
        3) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
        4) Training was generally sufficient for the proposed curriculum.

6. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)

G. If a representative of the Manufacturer is used in the instructional course, the Contract must be present throughout the extent of the course and ensure that the representative abides by the requirements set forth in these specifications.

H. Following training occurrence, submit completed training records no later than 5 days following end of training.

END OF SECTION 11 61 43

SECTION 11 61 62 - THEATRICAL LIGHTING S STEMS

PART 1 - GENERAL

1.1 SUMMAR

A. Provision of the Theatrical Lighting Systems at the Auditorium and Black Box.

B. This section also includes ADD ALTERNATES to the contract.

1.2 RELATED DOCUMENTS

A. Theatre Lighting Systems Drawings (“TL” Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

B. Section 00 01 23: Alternates

C. Section 11 61 33: Theatrical Rigging Systems, drawings, and documentation.

D. Section 27 41 15: Audio-Visual Systems and Equipment, drawings, and documentation.

E. Division 26: Electrical Work drawings and documentation.

1.3 SECTION INCLUDES

A. Project instructions for the Contractor and System description details.

B. System product descriptions.

C. Project completion instructions for the Contractor.

1.4 RESPONSIBILIT AND RELATED WORK

A. Coordination, supply, installation, shipping, storage, inspection, commissioning, testing, instruction and warranties of the Theatrical Lighting Systems.

B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and fully functioning System.

C. Also includes:

1. Required licenses and permits including payment of charges and fees.
2. Verification of dimensions and conditions at the job site.
3. Provision of submissions.
4. Installation in accordance with the Contract Documents, Manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.

5. Extension of electrical service, including ground, to equipment locations.

D. The drawings included with this specification convey general system concepts. Where the plans do not show complete and accurate building details, the Contractor is responsible for making field measurements necessary to establish exact locations, relationships, and load capacities necessary for the installation of these systems.

E. Coordinate the work with the related documents and the scheduled work of other trades.

F. Conduit infrastructure system, including wire for AC Power and grounding for the Theatrical Lighting Systems, are provided as part of the Contract. Coordination between different disciplines is required to achieve a proper conduit system installation and power provisions for Theatrical Lighting Systems. All electrical installation shall be in accordance with Division 26.

G. Supply accessories and minor equipment items needed for a complete and fully operational system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

H. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires the Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

I. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Architect.

J. Execute all work in accordance with the NEC and all applicable State and Local codes, ordinances, and regulations.

K. If a conflict develops between the Contract Documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:

1. American National Standards Institute (ANSI)
2. American Society of Testing and Materials (ASTM)
3. Electronics Industries Association (EIA)
4. Institute of Electrical and Electronic Engineers (IEEE)
5. National Electrical Manufacturer’s Association (NEMA)
6. National Electrical Code (NEC)
7. National Fire Protection Association (NFPA)
8. Underwriters Laboratories (UL)
9. Occupational Safety and Health Administration (OSHA)
10. Entertainment Services and Technology Association (ESTA)
11. United States Institute of Theater Technology (USITT)
12. Illuminating Engineering Society (IES)

1.6 DEFINITIONS

A. In addition to Division 1 definitions, the following list of terms as used in this Section shall be defined as:

1. Owner – Fort Bend Independent School District
2. Project – George Bush High School Renovations and Additions
3. Consultant(s) – WJHW
4. Architect – Stantec
5. Contractor – The provider of all material, labor, and equipment necessary for the systems described in this Section
6. Furnish/Supply – To purchase, procure, acquire, and deliver complete with all necessary accessories (CWANA)
7. Install – To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, item, or equipment supplied by the contractor.
8. Provide – To furnish and install

1.7 DESCRIPTIONS AND REQUIREMENTS

A. Auditorium – Base Bid

1. Demount existing lighting control console and store in an Owner designated area for re-use once work is complete.
2. Existing architectural lighting preset station(s) to remain.
3. Provide upgrades to the currently installed theatrical lighting power distribution system and architectural lighting control system.
4. Provide a new data network for production lighting.
5. Provide new LED production lighting fixtures.
6. Provide stage edge safety light and controls.

B. Auditorium – Alternate #4

1. Replace existing multi-circuit plug boxes at the front-of-house (FOH) catwalk with new devices.
2. Replace existing multi-circuit connector strips, SO cable, and cable cradles at the stage with new devices.
3. Provide new console accessories to support the existing lighting control console.

C. Black Box – Base Bid

1. Existing architectural lighting preset station(s) to remain.
2. Provide upgrades to the currently installed theatrical lighting power distribution system and architectural lighting control system.
3. Provide a new data network for production lighting.
4. Provide production lighting control console.
5. Provide new LED production lighting fixtures.

D. Black Box – Alternate #5

1. Replace existing multi-circuit plug boxes at the pipe grid with new devices.

E. Focus

1. Contractor will hang, focus, and program lights to an Owner directed plot
2. The Owner may elect to generate their own plot. If not, the Consultant will provide this documentation.
3. If the Contractor finds any needed updates or changes before hang begins the Consultant or Owner will update the documents as needed.
4. The Contractor is responsible for tracking and updating all changes to the plot after it has been turned over for installation. These updates and changes may be provided to the Consultant as necessary.

However, the Contractor is responsible for these updates and may be provided the plot in an editable format to make the updates.

5. The Consultant produced plot will provide the following information if applicable for each fixture:

    a. Location
    b. Unit number for that location
    c. Type
    d. Area/purpose
    e. Mode
    f. Fixture universe/address

6. As part of turnover documents, the Contractor will be required to ensure the following are provided:

    a. An electronic version of the plot. Provided on a flash drive and preserved by the Contractor for at least the length of the warranty.
    b. A B-sized version of the plot mounted to foamcore-like material.
    c. All of the information listed above in number 5 and additionally all circuiting of fixtures.

7. As part of the final observation and testing (3.5) Consultant will verify the focus. The Contractor may elect to complete the focus before the final observation and make any changes noted by the Consultant at this time. If the Contractor elects to have the Consultant direct focus as part of final observation the following shall be provided:

    a. At least (10) days notice
    b. A board operator
    c. At least (2) people to perform the focus
    d. All required lifts and safety equipment
    e. A focus target. Person or figure
    f. Person or system to document any changes that arise as part of the focus

F. Console Programming

1. The Contractor shall create a starting show file for the project. The file will be loaded onto the console, provided to the Owner on a flash drive, and preserved by the Contractor for at least the length of the warranty. The Contractor will provide the starting show file to the Owner, if requested, following the requirements laid out in the warranty portion (1.14) of this specification and shall be considered a service call.
2. Owner may select to add, update, or change any of the information below. These changes may be directed before, during, or after initial training. The Contractor will make any requested changes provided any amount of training time is left in the project as outlined in the instruction of Owner personnel of this specification (3.6).
3. At the Owner’s request program any fixture, color, or controllable attribute to provided faders.
4. Ensure all areas outlined in the console programming portion of this specification are covered as part of the instruction of Owner personnel of this specification (3.6).
5. Using the provided plot, the Contractor shall create the following console programming at a minimum, if applicable:

    a. Patching
    b. Patch all fixtures to channel numbers outlined in the plot.

6. Groups

    a. (1) group for every area of the plot.
    b. (1) group for every “row” of front lights
    c. (1) group for every “row” of front lights from the left
    d. (1) group for every “row” of front lights from the right
    e. (1) group for every “row” of top lights
    f. (1) group for every “row” of backlights
    g. (1) group for the cyclorama lights

7. Palettes

    a. Intensity

1) Provide a 70% intensity for use in creating cues

b. Color

1) Provide warm (R02) and cool (R3202 or R60) for ease of selection.
2) Provide a red (R27), green (R90), and blue (R80) for use on cyclorama fixtures
3) A warm white. Roughly 3200K

8. Interactive Control Display (Magic Sheet)

a. Provide an interactive control display to aid in programming and console use
b. The interactive display shall utilize a combination of standard and user-defined symbols to generate a fixture layout which copies the light plot as closely as reasonably possible.
c. Selectable fixtures will, at a minimum, indicate the following parameters or palettes and their current states:

1) Fixture type
2) Channel
3) Intensity
4) Color
5) Focus

d. Provide controls for all groups as described above

1.8 QUALIT ASSURANCE

A. Contractor’s Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:

1. No less than five (5) years of experience with equipment and systems of the specified types.
2. Experience with at least five (5) comparable scale projects within the last two (2) years.
3. Engage the services of a Manufacturer certified technician.
4. Be a franchised dealer and service facility for the manufacturer’s products furnished.
5. Maintain a fully staffed and equipped service facility.
6. At the request of the Architect, demonstrate that:

a. Adequate plant and equipment are available to complete the work.
b. Adequate staff with commensurate technical experience is available.

B. Manufacturer's Qualifications:

1. No less than five (5) years continuous experience in the production of specified type of product.
2. Production shall meet applicable NEMA standards.

1.9 SUBMITTALS:

A. Provide submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures section unless otherwise indicated.

B. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work until all submittal information has been approved.

C. Submittals must be original work produced by the firm responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the

effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.

D. Project Submittal Part 1:

1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:

    a. Section 1: A complete schedule of submittals.
    b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.

E. Project Submittal Part 2:

1. Provide for approval no later than sixty (60) days after issuance of Notice to Proceed and in accordance with previously submitted submittal schedule.
2. Products:

    a. Section 1: Complete list of products to be incorporated within the Work (Bill of Materials).
    b. Section 2: Manufacturer's data sheets for each product.

        1) Provide original manufacturer's data sheets in order as they appear in the specification.
        2) Data sheets are required for each product in sufficient detail to evaluate product suitability for incorporation within the Work.
        3) Product literature shall include documentation of UL Listing or approved recognition by a Nationally Recognized Testing Laboratory (NRTL).

    c. Section 3: Provide Architect and/or Architect's Consultant with samples of wall plate materials and colors as specified in this section.
    d. Section 4: Submit Safety Data Sheets (SDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the SDS.

3. Drawings:

    a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system. Electronic files of theatrical lighting contract documents shall not be distributed for use in generating submittal documents with the exception of Architectural backgrounds.
    b. Schematic Drawings.

        1) Provide drawings detailing cabling-riser intent.
        2) Give each component a unique designator and use this designator consistently throughout the project.
        3) Include inter- and intra-component connections and cabling diagram depicting cable types, designators, and color codes.

    c. Installation Drawings.

        1) Provide drawings showing the coordinated locations of all installed equipment. Drawings shall include floorplans and other views as necessary to fully describe the intended finished conditions.
        2) Provide Conduit and Electrical Drawings indicating:

            a) Conduit sizing/routing for each system component,
            b) Locations where power is required along with the location of all junction boxes.

        3) Detail Drawings: Provide drawings showing special details depicting methods and means specific to each product, assembly and each product Manufacturer's recommended installation methods and means.

d. Equipment Drawings:

1) Rack and Panel Elevations: Provide a front elevation of all racks and/or panels.
2) Rack and Panel Assembly Details: Provide drawings showing location of equipment in racks with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
3) Custom Enclosures and Millwork Drawings: Provide full fabrication detail drawings indicating size, material, finish, and openings for equipment.
4) Fabricated Plates and Panels Drawings: Provide complete drawings of custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.

e. Schedule Drawings: Provide load schedules noting source and destination of wiring and associated connected load.
f. Labeling Drawing: Provide representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.
g. General Detail Drawings: Provide detail drawings depicting any unique installation methods specific to each product.
h. Control Screen Templates: Provide layout drawings and/or screenshots for master house lighting stations and similar electronic control surfaces.

4. Any other pertinent data generated which is necessary to provide the Work.

F. Submittal Format:

1. Electronic (PDF) submittal documents are required for review.
2. Provide each submittal with a unique number and each shall be numbered in consecutive order.
3. Submittals shall not be issued with other disciplines.
4. Provide each submittal with a complete table of contents with the following information:

a. Project Name
b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and shall be numbered in consecutive order.
c. Date of submission.
d. Referenced specification Section, Part, Article, Paragraph, and page number or drawing reference as applicable.

5. Follow list by Manufacturer’s data sheets, arranged as in Part 2 of this specification. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
6. Drawings executed at an appropriate scale, but not smaller than 1/8 1'-0”.

G. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review as directed.
2. Indicate any changes that have been made other than those requested.
3. Approval of Submittals: Each submittal package will be returned with one of the following stamps:

a. “No Exceptions Taken” proceed with construction; all job site coordination will be at the direction of the General Contractor.
b. “Make Corrections Noted: No Resubmission Required” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
c. “Make Corrections Noted: Submit Only Corrected Pages/Items” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
d. “REJECTED, Submit Specified Item” a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
e. “REJECTED, Revise and Re-submit” submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.

f. “No Review Action Required” all information provided was for information or coordination purposes only. Review is not required.

4. Any of the above stamps may also carry a “PARTIAL” stamp. This indicates that required information noted in the section above was not provided. Omitted items may be noted as part of the reviewed submittal, but it is the Contractor’s responsibility to verify all required submittal documentation.

1.10 PROJECT RECORD MANUAL

A. Provide electronic copies of the project record documents or as required per the General Conditions of the Project.

B. The Project Record Manual shall be segregated into three separate bindings as follows:

1. As-Built Record Documents:

a. Product Data:

1) List of all products incorporated in the Project inclusive of all substitutions, field changes, or revisions The list shall include Manufacturer’s serial numbers.
2) Manufacturer's data for each type of product conforming to the scheme above.
3) Organize and bind the above in specification order.

b. Record drawings: Final rendition of project drawings enumerated in the Submittal section above. Provide editable computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system, in both a DWG and PDF file format.
c. Test Reports: Record findings of systems testing described in Part 3 below.

2. Operations Manual

a. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.

1) This procedure should describe the operation of all system capabilities.
2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.

3. Service & Maintenance Manual:

a. Provide an original copy of the service manual on every piece of equipment for which the Manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
b. Manufacturer’s maintenance and care instructions.
c. Maintenance Instructions: include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

4. Warranty Manual:

a. Manufacturer's warranty statements on each product.
b. Date of substantial completion and ending dates for warranties for each group of products.
c. Software registration and licenses.

5. Include any other pertinent data generated during the Project or required for future service.
6. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.11 DELIVER , STORAGE, AND HANDLING

A. Products shall ship and be stored in their original container to prevent damaging or entrance of foreign matter.

B. Provide protective covering during construction to prevent damaging or entrance of foreign matter.

C. Replace, at no expense to Owner, product damaged during storage, handling, or the course of construction.

1.12 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.13 FINAL TESTING AND OBSERVATION

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Consultant.

B. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

1.14 WARRANT

A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost associated with this warranty repair is the responsibility of the Contractor.

B. This warranty is in addition to any specific warranties issued by Manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

D. During the warranty period, the Manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service request. If callback is required, calls shall be answered within thirty (30) minutes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed to establish a standard of product function, performance, and quality. Products or manufacturers listed herein are listed in no particular order or preference.

B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure. Substitution of any equipment within this specification shall require review and approval by WJHW.

C. Substitution of specified products with other qualified manufacturers and products will be considered providing:

D. A request for substitution of each specific product must be made in writing by a bidding Contractor not less than ten (10) business days prior to bid for written approval of the Architect.

E. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.

F. Written permission is obtained for the substitution from the Owner or Owner's Representative.

G. Providing product not specifically specified without prior written approval by the Owner, Architect, and/or Architect's Consultant shall not be accepted.

2.2 GENERAL

A. Products shall be new, free from defects and listed by an NRTL when an applicable NRTL Standard exists. Provide product of a given type from one manufacturer.

B. Provide product of a given type from one manufacturer.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

2.3 CABLING AND ACCESSORIES

A. All cable shall be compliant with NEC and NRTL listed. Any NRTL listing must be available at the time of bid.

B. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)

C. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

D. Where cables are routed through cable tray, provide tray rated cable of equal specification.

E. Where cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

F. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

G. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Carol, Liberty, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables.

H. DMX512 (E-DMX) distribution cable:

1. Provide 24 AWG four twisted pair data cable.
2. Pair Color Code Chart:
    a. 1 – White/Blue Stripe and Blue
    b. 2 – White/Orange Stripe and Orange
    c. 3 – White/Green Stripe and Green
    d. 4 – White/Brown Stripe and Brown
3. Insulation: Polyolefin
4. Inner/Outer Jacket Material: PVC – Polyvinyl Chloride
5. Nominal Impedance: 100 ohms.
6. Nominal Velocity of Prop.: 72%
7. Capacitance between conductors: 15.0 pF/ft.
8. Acceptable product:
    a. Belden 1583A (Category 5E).

I. DMX512 (E-DMX) distribution cable – Stage Electric Drops

1. Provide extra rugged, flexible control cable (Ethernet) for connection of NET outlets on grid to electric batten distribution.
2. Cable to be four-pair, double shielded, low-capacitance.
3. Conductors: 26 AWG tinned, annealed copper stranded 7 x 0.16.
4. Connector: Provide with EtherCon connector by Neutrik□.
5. Assembly: pairs cabled with Kevlar strength member.
6. Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
7. Conductivity: 15ohms per 100 meters 20C.
8. Impedance: 100 □15 ohms 1-100MHz.
9. Acceptable product:
    a. TMB & Associates ProPlex or equivalent.

J. DMX512 Backup Control Signal Distribution Cable:

1. Provide 24 AWG two twisted pair cable.
2. Insulation: Foam polyethylene.
3. Shield: aluminum foil/polyester tape.
4. Capacitance between conductors: 12.5 pF/ft.
5. Acceptable product:
    a. Belden 9729

K. Architectural Lighting DMX Cable:

1. Provide 24 AWG two twisted pair cable.
2. Insulation: Foam polyethylene.
3. Shield: aluminum foil/polyester tape.
4. Capacitance between conductors: 12.5 pF/ft.
5. Acceptable product:
    a. Belden 9842

L. Preset Station Signal Distribution Cable:

1. Provide 16 AWG single twisted pair cable.
2. Insulation: PVC-polyvinyl chloride.
3. Shield: unshielded.
4. Capacitance between conductors: 33 pF/ft.
5. Acceptable product:

    a. Belden 8471

M. Multi-Conductor SO Type Cable: (ALTERNATE #4)

1. Provide multi-conductor cable with black neoprene jacket.
2. Conductivity: not less than 98%.
3. Conductor: soft drawn annealed stranded copper.
4. Minimum Conductor Temperature: 90□C.
5. Size: No. 12 AWG minimum.
6. No. of Conductors: As required by circuits shown.
7. Acceptable product:

    a. Cole Wire & Cable
    b. Carol
    c. Rome

2.4 POWER DISTRIBUTION

A. Relay Modules:

1. Relay modules shall be plug-in type;
2. Provide modules containing either two relays per module or four relays per module, to match existing dimmer rack.
3. Modules shall be constructed of aluminum;
4. Modules shall contain fully magnetic circuit breaker(s), solid state switching module(s), choke(s), and connectors;
5. Each module shall have the capability to operate in a non-dimmed mode;
6. Power efficiency shall be at least 97% at full load;
7. Each relay shall be equipped with a rated, fully magnetic circuit breaker that shall be mounted in the face plate of the module;
8. Quantity:

    a. Auditorium – (26)
    b. Black Box – (4)

9. Acceptable product:

    a. Auditorium – Vari-Lite C21 Dual Relay modules, 20A
    b. Black Box – Vari-Lite A21 Quad 2400W non-dim module, 120V

B. Mini Relay Panel (RP/ERP)

1. Provide a small-format DMX controlled relay panel for load circuit distribution as described on the drawings.
2. Mechanical

    a. Panel shall be constructed of 16AWG steel and finished in a black fine-texture powder paint.
    b. Panel shall support wall and ceiling mounting, including installation in plenum air return spaces.
    c. A removable dead front cover shall be mechanically fastened using four screws.

d. An internal safety cover made of 16AWG steel shall prevent access to all line voltage (Class 1) wiring and components without limiting access to low voltage terminations, changing settings during commissioning, or manual control of relays.

3. Functionality

a. Panel shall be available in multiple zone configurations with a 20A, fully–rated, relay output and 0-10V dimming output per zone.
b. Panel shall be UL924 LISTED for emergency lighting circuits and shall activate only the selected outputs. Excluded loads shall be shed and not output during emergency conditions
c. Panel shall support onboard configuration without the use of software.
d. Panel shall support a contact input for use in UL 924 Emergency Systems
e. A dry contact input shall provide triggering of an emergency condition
f. A three-position switch shall set the input as Normally Open (NO) Normally Closed (NC), or Off.

4. Electrical

a. Power Input shall support 120-277 Volts AC 47-63Hz for control electronics and for each independent zone.
b. Panel shall provide a 20A, fully rated, normally open relay for each output rated for lighting and plug load use.
c. A 0-10V dimming output per zone shall support 0-10V sink control rated for 100mA per output.
d. 0-10V wiring shall be fully isolated from ground within the Panel.
e. Panel shall support Class 2, ANSI E1.11-2008, USITT DMX512A control communications
f. Panel shall provide a DMX512A wiring connection using terminal blocks for #24 AWG wire
g. Panel shall be designed and tested to withstand discharges up to 15,000 volts (IEC 801-2) without impairment of performance.
h. Panel shall provide a three-position terminal for power input to the control electronics. The control power input shall accept 6-14AWG wire and be clearly marked Line, Neutral and Earth Ground
i. Each relay shall provide three screw terminals for line voltage power connection. Each terminal shall accept 6-14awg wire and be clearly labeled Input, Output and Thru.
j. Panel shall support 0-10V dimming control via two 16-26AWG terminals for 0-10V and 0-10V common wiring connections.

5. Quantity: As shown in drawings.
6. Acceptable product:

a. Pathway SNAP 4851-8
b. ETC Foundry Mini Panel: UFMP8
c. Vari-lite RigSwitch Architectural Power Platform

C. Distribution Wiring Devices

1. General

a. All power distribution devices overall assembly shall be listed by a nationally recognized test lab.
b. All dimmed circuit connectors shall be 20A grounded stage pin type. All switched circuits connectors shall be 20A stage pin type. All connector types provided shall be of a single manufacture.
c. All pigtails shall be three-wire type “SOW” rubber jackets cable. All pigtails to be provided with proper strain relief.
d. All power distribution devices shall be fabricated from minimum 18-gauge galvanized steel and finished in black fine-textured powder coat paint unless noted otherwise. Boxes shall be free from burrs, sharp corner, and overhanging edges.
e. Circuits for Raceways and Plugging Boxes shall be labelled with 2” yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings.
f. Circuits for Wall Boxes and Floor Pockets shall be labelled with 1” yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings. As a rule, circuits shall number Stage Left to Stage Right, Down stage to Upstage.
g. All power distribution devices shall be provided with appropriate mounting hardware.

h. All multi-conductor cable is to be provided with Kellems-type strain relief grips at each end of the cables with intermediate strain relief as required.
i. Provide connector strips, gridiron junction boxes (GIJB), and associated hardware for over the stage lighting. Coordinate connector strip lengths for electrics with the theatrical rigging equipment. Provide all multi-conductor cables allowing the devices to fly to a low trim as indicated on the TR sheets. The cable is to be provided with necessary cable strain relief grips as part of the cable management system. Provide rugged network control cables to parallel the multi-conductor cable runs. Verify all electrical circuits and label all circuit numbers as specified.

2. Wall Mounted Boxes (WB)

a. Provide a wall plug-box designed for recessed mounting.
b. Construction: code gauge steel.
c. Connectors: female 20 Ampere stage pin connectors surface mounted in the plug-box.
d. Circuits: number of circuits as specified on drawings.
e. Labeling: circuits are labeled with yellow letters on black background.
f. Overall assembly UL listed.
g. Quantity: As shown in drawings.
h. Acceptable product:

1) Altman 450 series
2) ETC 9200 series
3) SSRC RM series

3. Pipe Mounted Boxes (PB) – ALTERNATE #4 / ALTERNATE #5

a. Provide a plug box designed for pipe mounting.
b. Construction: code gauge steel.
c. Pigtails: SO type cable. Provide lengths as shown on drawings.
d. Connectors: female 20A twistlock connectors on the end of each of the pigtails and flush mounted 20A parallel blade receptacles for convenience circuits.
e. Circuits: number of circuits as specified on drawings.
f. Labeling: circuits are labeled with yellow letters on black background.
g. Overall assembly UL listed.
h. Quantity: As shown in drawings.
i. Acceptable product:

1) Altman 450 series
2) ETC 9300 series
3) SSRC PM series

4. Floor Pocket (FP)

a. Provide replacement receptacle plates for the existing floor pockets.
b. Panel mounted connectors:

1) 20A 2P&G stage pin for switched circuits.
2) 20A parallel blade for convenience circuits

c. Labeling: circuits are to be labeled with yellow letters on black background.
d. Quantity: As shown in drawings.
e. Acceptable product:

1) Altman 450 series
2) SSRC FP series
3) ETC 8500 series

5. Gridiron Junction Boxes (GJB) – ALTERNATE #4

a. Provide a junction box designed to mount to the gridiron structure.
b. Construction: 16-gauge, cold rolled steel with removable covers.
c. Size: minimum 18”W X 6”H X 12”D with four mounting holes. Box will be provided to properly to accommodate number of circuits specified on drawings.
d. Finish: fine-texture, scratch resistant, black-powder coating.

e. Termination: barriered, screw clamp type terminal strip(s). Terminals to be sized for the circuit, according to the circuit amperage as required.
f. Grounding: junction box will have grounding lugs.
g. Up to two (2) GIJBs may be required per stage electric; reference circuit count per drawings.
h. Overall assembly UL listed.
i. Provide Kellems-type grips for each multi-conductor cable entering the junction box.
j. Acceptable product:

1) Altman GJB series
2) ETC 8700 series
3) SSRC GB series

6. Distribution Raceway (R) – ALTERNATE #4

a. Provide a connector strip style connector device designed for mounting to pipe battens. Unit is to have a barrier strip for use in conjunction with control network distribution.
b. Construction: 16-gauge, cold-rolled steel with removable covers.
c. Size: approximately 4”X4” in section, provided in lengths as shown on TR drawings.
d. Finish: fine texture, scratch resistant, black powder coat.
e. Bracket: provide (1) steel hanging bracket for every five (5) feet of strip.
f. Pigtails: SO type cable, 18” in length with Heyco strain relief.
g. Connectors: female 20A twistlock connectors on the end of each of the pigtails and flush mounted 20A parallel blade receptacles for convenience circuits
h. Circuits: number of circuits as specified on drawings with labels on both sides of connector strip.
i. Termination: circuits terminated at a barrier terminal strip in a terminal box located, as specified on drawings.
j. Overall assembly UL listed.
k. Quantity: As shown in drawings
l. Acceptable product:

1) Altman 450 series
2) ETC 9900 series
3) SSRC BAL series

7. SO Cable Cradles – ALTERNATE #4

a. Provide properly sized cable cradles for SO cable service from gridiron junction box to plug-strip connector device.
b. Acceptable product:

1) ETC 8800 Series
2) Altman 512 Series.

8. SO Cable Kellems-type Grips – ALTERNATE #4

a. Provide properly sized Kellems-type grips for SO cable service from gridiron junction box to plugstrip connector device.
b. Quantity: As required for the specified number of circuits
c. Acceptable product:

1) Hubbell or equivalent.

2.5 CONTROL EQUIPMENT

A. Control Distribution Rack (CDR)

1. The control distribution rack shall be an EIA compliant 19” wall mount rack.
2. Center section and back pan shall be 16 gauge steel, finished in a black textured powder coat.
3. Rack rails shall be constructed of 11 gauge steel with tapped 10-32 mounting holes in universal EIA spacing.
4. Rack height shall be sized to contain all equipment as shown in the contract documents.
5. Rack shall have an overall depth of 22.3.” Useable depth shall be 20,” extending into the back pan 3.5.”

6. Accessories:

    a. Provide a Furman M-8Lx type pull out panel light in the rack.
    b. Provide one (1) locking storage drawer and all necessary vent or blank panels.

7. The control distribution rack shall be provided by the Lighting Control System Manufacturer.
8. Quantity and details: As shown on drawings
9. Acceptable product:

    a. Mid-Atlantic DWR series

B. UPS Backup Power / Surge Protection

1. Provide a rack mountable UPS backup to support equipment located in the control distribution racks (provide with one (1) spare battery).
2. Output Power Capacity: 1400VA/1050W
3. Input 120V/ Output 120V
4. Interface Port: DB-9 RS-232
5. Extended runtime model
6. Rack Height: 2 Units
7. Filtering: Full time multi-pole noise - filtering: 0.3% IEEE surge let-through: zero clamping response time: meets UL 1449
8. The UPS shall be provided by the lighting control system manufacturer.
9. Quantity: As shown in drawings.
10. Acceptable product:

    a. APC
    b. Tripp Lite
    c. Middle Atlantic

C. Control Components

1. Ethernet Switches (ESW)

    a. Provide business grade Gigabit PoE , Layer 2 managed Ethernet switches in the CDR as shown in the TL series documents.
    b. Switch shall include 24 POE ports meeting IEEE802.3at standard
    c. Switch shall include port routing via separate VLAN subnets
    d. Switch shall be equipped with LED indicators for power status, port status, bandwidth utilization, collision detection and speed indication.
    e. Switch shall have a built-in web-based management interface to provide easy to use management through a standard browser. Provide with all required software management tools.
    f. Provide rack mount kit and required hardware and cables for stacking.
    g. Each network location shall have a dedicated input point on the network switch. Dedicated input points shall be clearly labeled to identify connected network device at the patch panel. Patching shall not be required.
    h. Ethernet switch shall be tested and approved by Lighting Control System Manufacturer for compatibility with all connected devices.
    i. Quantity: As required by design

2. Network Node/Gateway

    a. Provide rack-mounted DMX Ethernet node/Gateway to generate DMX to devices located at theatrical and house architectural lighting positions
    b. Nodes shall have (4) screw terminal or 5-pin DMX connectors for a total of 4 DMX universes for distribution over the Ethernet system.
    c. DMX Node shall have LEDs for indication of power, network activity, and DMX port configuration.
    d. Each input shall route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
    e. Quantity: As required by design.
    f. Acceptable product:

1) Pathway rack-mounted gateway
2) Vari-lite rack-mounted gateway
3) ETC rack-mounted gateway

3. eDIN Demultiplexer Module:

a. Provide a rack mounted DMX to 0-10v signal converter for house lighting as required. Reference Division 26 documents.
b. Each architectural circuit shall have an independent output by the Demultiplexer; there shall be no daisy chain runs between circuits.
c. Quantity: As required by Design.
d. Acceptable product:

1) Pathway Connectivity #1004 Demultiplexer (DMX-to-Analog)
2) ETC Response 0-10V Gateway

D. Plates and Devices

1. Network Receptacle Station/Gateway (NET)

a. Provide a remote plug-in station for connection of control console and portable DMX Gateways at control booth and other locations as noted in the drawings.
b. Station shall be provided with a Neutrik RJ45 jack. Each jack shall be rated for use in harsh commercial conditions.
c. Station will contain the following components:

1) RJ 45 jack with punch down block, provide Neutrik EtherCon type receptacle as indicated on drawings.
2) Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat.
3) Station back box will be a minimum of 2.5 inches.
4) Station shall have silk screened graphics white in color.
5) Provide a Lamacoid label that de-notes, using an alpha-numeric labeling convention, the switch location and network port number.

d. These network connections shall also be configured with a back box and mounting hardware for mounting on the FOH lighting galleries or backstage.
e. Each Network jack will route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
f. No daisy chaining between jacks or splicing of Category 5e and above cable is allowed.
g. Quantity: As shown in drawings.
h. Acceptable product:

1) Pathway Network station
2) Vari-lite station
3) SSRC station
4) ETC Network station

2. DMX512 Distribution Box/Network Gateway (NN2):

a. Provide a plug-in box designed for pipe mounting.
b. Node shall provide the quantity of universes, as specified, of DMX512 control for intelligent lighting or other DMX512 addressable devices.
c. Power for the node shall be provided over the Cat6 cable via the network switch. All nodes shall be IEEE 802.3af compliant and UL listed. Power consumption shall not be greater than 3 watts.
d. Ports:

1) DMX Ports shall comply with the requirements of the USITT DMX512.
2) The DMX port shall be software-configurable for either input or output.
3) DMX inputs shall be fully opto-isolated from the node electronics and from each other.
4) DMX outputs shall be earth-ground referenced.
5) DMX Ports shall be capable of withstanding fault voltages of up to 250VAC without damage.

e. Node modules will mount within a standard electrical box or enclosure.
f. Each input shall route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
g. Quantity: As shown in drawings.
h. Acceptable product:

1) Pathway Connectivity Pathport Node
2) Vari-lite Node
3) ETC DMX Node

3. Portable Network Gateways:

a. Provide portable output nodes and input node for pipe mounting at any NET station.
b. Each node shall be equipped with a molded RJ 45 connector on a jacketed cable (see specification for flexible Category 6 cable) for connection to the lighting control network (NET).
c. Node shall provide the quantity of universes, as specified, of DMX512 control for intelligent lighting or other DMX512 addressable devices.
d. Power for the node shall be provided over the Category 6 cable via the network switch. All nodes shall be IEEE 802.3af compliant and UL listed. Power consumption shall not be greater than 3 watts.
e. Ports:

1) DMX Ports shall comply with the requirements of the USITT DMX512.
2) The two DMX ports shall be software-configurable for either input or output.
3) DMX inputs shall be fully opto-isolated from the node electronics and from each other.
4) DMX outputs shall be earth-ground referenced.
5) DMX Ports shall be capable of withstanding fault voltages of up to 250VAC without damage.

f. Double Universe Node shall contain the following components:

1) RJ 45 connector. Connector is to be RJ Lnxx model ENSAM315.

g. Provide C-clamp for pipe mounting.
h. Quantity: (4) Output Nodes and (2) Input Nodes
i. Acceptable product:

1) Pathway Connectivity Pathport Node
2) Vari-lite Node
3) ETC Portable DMX Node

4. DMX512 Distribution (DMX):

a. Provide DMX512 distribution for connection to wiring devices in the Classroom and Auditorium.
b. Modules shall provide one optically isolated DMX512 signal output capable of driving thirty-two (32) receiving devices on a single DMX line.
c. Provide a wall plugging box designed for surface mounting.
d. Construction: code gauge steel.
e. Connectors: Neutrik 5 conductor XLR, flush mounted.
f. Circuits: located as shown on the drawings.
g. Labeling: labeled with yellow letters on black background.
h. Quantity: As shown in drawings.
i. Acceptable product:

1) Pathway Connectivity station
2) Vari-lite station
3) SSRC station
4) ETC station

5. Control Receptacle Station (CR#)

a. Provide a flush-mounted control station for connection of the control console over network.

1) Provide with DMX receptacles as described on the drawings.

b. Station will contain receptacle components as described on the drawings.
c. Station faceplates shall be .80” aluminum, finished in fine texture, scratch resistant black powder coat.
d. Station Back box will be a minimum of 2.5 inches deep
e. Station shall have white, silk screened graphics
f. Provide a Lamacoid label for network jacks that denotes, using alpha-numeric labelling convention, the switch location and network port number.
g. Each network jack shall route directly to the Ethernet switch without the need for patching.
h. No daisy-chaining between jacks or splicing on network cabling is allowed.
i. Quantity: As shown in drawings.
j. Acceptable product:

1) Pathway Connectivity station
2) Vari-lite station
3) SSRC station
4) ETC station

2.6 CONTROL CONSOLE AND ACCESSORIES

A. Overview

1. Use the currently installed control console for direct operation of theatrical fixtures and development of user-presets to be stored for recall via the Architectural Control Sub-system specified in this section.
2. Provide initial setup as directed as part of the system commissioning process.

B. Black Box Control Console

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems.
2. The system shall also be able to control third party ACN devices directly. The system shall provide control of 1,024 or 6,144 outputs on a maximum of 32,768 control channels.
3. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.
4. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.
5. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.
6. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device.
7. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.
8. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.
9. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using softkeys with no LCD display shall not be acceptable.
10. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.
11. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.
12. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.
13. Accessories:
    a. Provide (2) external touchscreens high resolution DVI monitors that will display system information, including playback status, live output and blind values for all record targets.

b. Provide (1) fully-functioning, detachable alphanumeric keyboard. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.
c. Provide with dust cover
d. Provide with USB mouse
e. Provide with 25’ network control cable
f. Provide (1) Littlite with 3-pin XLR connector
g. Provide (1) USB jump drive, minimum 8gb

14. Quantity: (1)
15. Acceptable product:

a. Electronic Theater Controls Element 2 with 6,144 channels of control

C. Auditorium Handheld Remote Focus – ALTERNATE #4

1. The portable access unit shall be a wired or wireless remote-control device that allows access to console programming and playback functions.
2. The device shall be an 8-inch tablet with a capacitive multi-touch display.
3. Remote unit shall connect through an RJ45 and wirelessly via a WAP
4. Contractor shall provide WAP that meets District standards for WiFi function and security
5. Contractor shall provide the following accessories:

a. Charging/cable Adaptor
b. Hand Strap.
c. Shoulder Strap
d. EETI Stylus Pen
e. Office Dock
f. VESA Dock

6. Acceptable product:
a. Electronic Theatre Controls ETCpad

2.7 ARCHITECTURAL CONTROL S STEM

A. Stations - General

1. All new stations should be compatible with the existing architectural control system.
2. Master stations shall be located in the control booth, backstage and as noted on the contract documents.
3. Provide preset stations as described below and shown in drawings.
4. All audience exposed switches shall be provided with locking covers and shall be painted a custom color as determined by the architect.

B. House Lighting Fixture Control

1. Contractor shall be responsible for installation and termination of DMX and/or 0-10v to all architectural house light fixtures. It is the Contractor’s responsibility to verify operation on ground before fixtures are permanently installed. Any required DMX and/or 0-10v controlled interface shall be provided by the Contractor including equipment parts, labor and installation of equipment.

C. Control Stations/Receptacles

1. SMP Rack Panel (SMP)

a. Provide standard 19” panel to be mounted in SMP rack provided under 27 41 15
b. Panel shall contain the following:

1) Existing downstage left House Light Master touchscreen station (HLM)
2) (2) Neutrik RJ-45 network receptacle (NET)

3) Network labels as required
4) On/Off switch for Stage Edge Safety Light power supply

c. Coordinate panel size and material type to match AV components in the SMP rack.

2. Push Button Preset Stations (HL2)

a. Provide two push button stations as shown on drawings
b. Stations shall be mounted within a one-gang back box
c. Station finish shall be black in technical areas color selected by Architect for public spaces.
d. Two button stations (HL2) shall be programmed for on/off operation with on button being a fully programmable preset
e. Quantity: As shown on the drawings.
f. Acceptable product:

1) Vari-lite Vision.net

2.8 EMERGENC LIGHTING EQUIPMENT

A. Emergency DMX Bypass Control (EDB)

1. Provide a bypass means to trigger special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations
2. The Emergency DMX Bypass shall be capable of overriding a single universe of ANSI E1.11–2008, USITT DMX512-A control signals from “Normal” to “Bypass” when a trigger signal is detected.
3. The DMX Emergency Bypass Controller shall poll the bypass trigger input after a power loss and react upon start up.
4. The default or recorded sequence shall be recalled immediately on restart if the trigger is also applied at restart.
5. The Emergency DMX Bypass enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier.
6. The Emergency DMX Bypass shall have a LED indicator visible from the exterior of the enclosure.
7. The Emergency DMX Bypass shall be UL Section 924 Listed for interaction with similarly listed products.
8. Quantity: As shown on drawings.
9. Acceptable product:
   a. Electronic Theatre Controls DMX Emergency Bypass Controller
   b. Vari-lite DMX Bypass

B. Phase Loss Monitor (PLM)

1. Provide a means to detect the loss of normal power and trigger special-purpose lighting presets.
2. Phase Loss Monitor enclosures shall support 100V to 277V configurations
3. E Phase Loss Monitor enclosures shall be field configurable for single-phase, bi-phase, and three-phase operation without the need for additional components.
4. The Phase Loss Monitor shall be completely pre-wired by the manufacturer. The contractor shall provide input feed and control wiring.
5. All control wire connections shall be terminated via factory provided connectors.
6. The Phase Loss Monitor shall be UL and Section 924 Listed for interaction with similarly listed dimming and switching panels.
7. Quantity: As shown on drawings.
8. Acceptable product:
   a. ETC Emergency Bypass Detection Kit
   b. Vari-lite Phase Loss Sense Panel

2.9 MISCELLANEOUS

A. Stage Edge Safety Light

1. Lamp: SKL Square Krystal-Lite (waterproofed) on 6 spacing

2. Bulb Type: Red, white at the center
3. Housing: SC Channel; .41 profile, U channel for inlayed/surface design - field verify all dimensions.
4. Coordinate installation with Electrical.
5. Transformer: Provide appropriately sized transformer for custom length. Stage edge light to be controlled through the dimming system, provide any DMX interface as needed.
6. Ensure control interconnectivity to orchestra pit as needed. Stage edge should switch between fixtures based on pit location automatically.
7. Overall assembly is to be UL listed.
8. Quantity: (1) As shown on drawings
9. Acceptable Product:

    a. Vista Light Strip (with SKL lamps)
    b. Future-Light Edge Light
    c. Tivoli Stage Edge

B. LED Stage Electric Work Lights

1. Provide a high output LED work light capable of clamping onto the top batten of the stage electrics.
2. Construction: Heavy duty anodized extruded aluminum housing. All materials shall be corrosion resistant.
3. Rating: 120/240 volts AC/DC operation.
4. Cable: 36” Teflon leads encased in black fiberglass sleeving.
5. Connectors: (1) male parallel blade
6. oke: Rigid flat steel with locking dog tilt handle.
7. Finish: All black enamel
8. Provide with yoke and c-clamp hardware
9. Quantity: (8)
10. Acceptable product:

    a. Altman LED Work Light
    b. SSRC LED Work Light, 150W Warm White
    c. MEGA LITE Drama WL 100 CW Work Light

C. Rolling Safety Light

1. Provide castered stand with safety caged compact fluorescent 100 watt equivalent lamp.
2. Provide (1) 30’ 12/3 cable terminating in a 20A U-ground connector. Mount cable hanger to stand.
3. Quantity: (1) Custom Safety Light
4. Acceptable product(s):

    a. Altman 526/5-9 with listed accessories

2.10 PORTABLE LIGHTING FIXTURES AND ACCESSORIES

A. Provide and integrate the following equipment into the project.

1. Theatrical Lighting Fixtures

    a. The portable lighting fixtures shall connect and be controlled by the new theatrical lighting control system.
    b. All fixtures shall be listed by UL or an OSHA approved NRTL.
    c. Fixtures shall be constructed of rugged die cast aluminum with high impact knobs and handles unless otherwise noted.
    d. Fixtures shall be provided with a black finish unless otherwise noted.
    e. Fixtures shall have a rugged steel yoke with a positive locking clutch which will allow for a 300□ body rotation.
    f. All fixtures shall be provided with color frame, power lead with mating grounded connector, safety cable, and c-clamp.
    g. Fixtures shall be:

1) Labeled with the Owner's mark and select numbering/labelling inventory scheme.
2) Bench-focused, if necessary.
3) Hung in the Owner's selected stock plot.
4) Patched at the console.

B. LED-type fixtures

1. Provide (1) power pass-through and (1) DMX extension cable at 10 ft. length for each LED-type fixture included in the inventory. All cables shall adhere to requirements set for below in Cables and Accessories portion of this specification.
2. All LED-type fixtures shall support ANSI E1.11 DMX512-A and ANSI E1.20 RDM standards.
3. All LEDs used in the product shall be high brightness and proven quality from established and reputable LED manufacturers.
4. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

C. Fixtures – Type and Quantity

1. Type 1 – High Intensity Color-changing LED Profile

a. Provide a six (6) color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have a shutter assembly with (4) blades mounted in two or more planes. Shutter blades shall be warp and burnout resistant;
c. Unit shall have two accessory slots, a top-mounted quick release gel frame retainer, and a slot with sliding cover for motorized pattern devices or optional iris.
d. Unit shall have projector-like quality pattern imaging, sharp shutter cuts without halation, and allow for both hard and soft beam edges;
e. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
f. Provide power lead with stage pin connector
g. Unit shall support power and DMX in and thru connections.
h. Provide the following quantity of lens tubes:

1) (12) 05□;
2) (12) 10□;
3) (12) 26□;

i. Quantity: (36)
j. Acceptable product:

1) ETC Source Four LED Series 2 Lustr (black) complete with lens tube
2) Vari-lite LEKO LED FC
3) Chauvet Ovation Reve E-3

2. Type 2 – Color-changing LED Profile

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have a shutter assembly with (4) blades mounted in two or more planes. Shutter blades shall be warp and burnout resistant;
c. Unit shall have two accessory slots, a top-mounted quick release gel frame retainer, and a slot with sliding cover for motorized pattern devices or optional iris.
d. Unit shall have projector-like quality pattern imaging, sharp shutter cuts without halation, and allow for both hard and soft beam edges;
e. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
f. Provide power lead with stage pin connector
g. Unit shall support power and DMX in and thru connections.
h. Provide the following quantity of lens tubes:

1) (08) 19□;
2) (08) 26□;
3) (08) 36□;

i. Quantity: (24)
j. Acceptable product:

1) ETC ColorSource Spot V
2) Vari-lite LED PLE

3. Type 3 – Color-changing LED Zoom-style Profile

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have a shutter assembly with (4) blades mounted in two or more planes. Shutter blades shall be warp and burnout resistant;
c. Unit shall have two accessory slots, a top-mounted quick release gel frame retainer, and a slot with sliding cover for motorized pattern devices or optional iris.
d. Unit shall have projector-like quality pattern imaging, sharp shutter cuts without halation, and allow for both hard and soft beam edges;
e. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
f. Provide power lead with stage pin connector
g. Unit shall support power and DMX in and thru connections;
h. Unit shall utilize an integral 25□-50□adjustable lens assembly;
i. Quantity: (24)
j. Acceptable product:

1) ETC ColorSource Spot jr Deep Blue
2) Vari-lite Acclaim LED Zoomspot
3) Chauvet Ovation E2-FC

4. Type 4 – Auditorium Color-changing LED Wash

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have an accessory slot with a top-mounted quick release gel frame retainer.
c. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply.
d. Provide power lead with stage pin connector
e. Unit shall support power and DMX in and thru connections.
f. Provide with (6) barn door assemblies and floor-stand yokes with base.
g. Quantity (30)
h. Acceptable product:

1) ETC ColorSource Fresnel V
2) Vari-lite Acclaim LED Fresnel
3) Chauvet Ovation F-915FC

5. Type 5 – Black Box Color-changing LED Wash

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have an accessory slot with a top-mounted quick release gel frame retainer.
c. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply.
d. Provide power lead with stage pin connector
e. Unit shall support power and DMX in and thru connections.
f. Provide one (1) NSP, MFL, and WFL round field lens with each fixture.
g. Quantity (24)
h. Acceptable product:

1) ETC ColorSource PAR Deep Blue
2) Vari-lite Acclaim LED Fresnel
3) Chauvet Ovation P-56FC

6. Type 6 – LED Cyclorama Fixture

a. Provide a four (4) color mixing high-intensity LED illuminator with DMX controlled intensity and color;

b. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
c. Provide power lead with stage pin connector
d. Unit shall support power and DMX in and thru connections;
e. Provide trunnion with c-clamps hanging bracket mounting for each fixture if manufacturer does not provide yoke-mounting hardware;
f. Acceptable product and quantity:

1) Vari-lite CODA LED Cyc (4).

7. Type 7 – LED Follow Spots - Auditorium

a. Provide a 6000K cool white high-intensity LED illuminator with DMX controlled intensity.
b. Construction: sheet metal housing with black finish. All materials will be corrosion resistant.
c. Rating: Long life LED source
d. High performance quartz condenser optical system.
e. 100% closing iris with black plate follower in a removable cassette.
f. Built in flicker free power supply.
g. A size double gobo holder on slide changer.
h. 6-way boomerang color changer fitted with removable filter frames.

1) Provide the boomerang loaded with gels selected by Owner. These gels will be provided separately from any allotment of gels within this specification.

i. Heavy duty adjustable yoke.
j. Heavy duty stand
k. Special hanging points at the rear of the unit.
l. Set of tools and first emergency spare parts.
m. Quantity: (2)
n. Acceptable Products:

1) Robert Juliat – OZ 600W LED
2) Altman AFS-700

D. Cables and Accessories

1. Extension Cables:

a. Provide extension cables for extending pigtail or wall box circuits to lighting instrument.
b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
c. Provide each cable with Velcro cable tie.
d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male and female grounded stage-pin connectors.
e. Quantity:

1) Auditorium

a) (16) 10 ft.
b) (08) 25 ft.

2) Black Box

a) (08) 10 ft.
b) (08) 25 ft.

f. Acceptable Products:

1) Lex Products PowerFLEX
2) TMB & Associates ProPower
3) Or approved equal

2. Adapter Cables

a. Provide adapter cables for extending pigtail or wall box circuits to lighting instrument.
b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
c. Provide each cable with Velcro cable tie.
d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male Edison connectors and female grounded stage-pin connectors.
e. Quantity:

1) (6) 1ft. with Male Edison and female stage-pin connectors
2) (6) 1ft. with Male stage-pin and female Edison connectors

f. Acceptable Products:

1) TMB & Associates ProPower
2) Lex Products PowerFLEX
3) Or approved equal

3. DMX-512 cable

a. Provide DMX-512 cables for connecting lighting consoles, moving lights, or other DMX controlled accessories to the Network Nodes.
b. Connectors shall be Neutrik 5-pin.
c. Provide 24AWG two twisted pair data cable.
d. Insulation: polyethylene.
e. Nominal Impedance: 100 ohms.
f. Nominal Velocity of Prop.: 78%.
g. Capacitance between conductors: 12.5 pF/ft.
h. Quantity:

1) Auditorium

a) (16) 10 ft.
b) (08) 25 ft.

2) Black Box

a) (08) 10 ft.
b) (08) 25 ft.

i. Acceptable Products:

1) TMB & Associates ProPlex
2) Lex Products PowerFLEX
3) Or approved equal

4. Flexible Category 5e Cable/NET Cable:

a. Provide extra rugged, flexible control cable (Ethernet) for connection of NET stations to portable Network Nodes.
b. Cable to be 4-pair, double shielded, low-capacitance.
c. Conductors: 24 AWG tinned, annealed copper stranded 7 x 0.16.
d. Connector: Provide with EtherCon connector by Neutrik
e. Assembly: pairs cabled with Kevlar strength member.
f. Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
g. Conductivity: 15ohms per 100 meters 20C.
h. Impedance: 100 □15 ohms 1-100 MHz
i. Quantity:

1) Auditorium

a) (4) 3’ Ethernet Cable
b) (4) 10’ Ethernet Cable
c) (2) 25’ Ethernet Cable

2) Black Box

a) (4) 3’ Ethernet Cable
b) (4) 10’ Ethernet Cable
c) (2) 25’ Ethernet Cable

j. Acceptable Products:

1) TMB & Associates ProPlex
2) Lex Products PowerFLEX
3) Or approved equal

5. XLR DMX Terminator

a. Provide XLR DMX male terminator
b. Connector shall be Neutrik 5-pin.
c. Termination resistance: 120 ohms /- 1et5her0% between pins 2 and 3
d. Termination power capacity: 2 watts
e. Quantity: (18)
f. Acceptable Product

1) ETC SGE 1507
2) Lex Products DMX5P-TERM

6. Beam Control Medium Sheets

a. Provide clear beam angle control medium for LED wash and LED Cyclorama fixtures
b. Beam control medium shall be clear polycarbonate with flame retardant additive
c. Provide (12) full size seamless sheets (24”x40”) of beam control medium
d. Acceptable product:

1) Rosco Opto-Sculpt

7. Pattern Templates (Gobos)

a. Provide eight (8) stainless steel image patterns.
b. Size and patterns shall be selected by the Owner.
c. Acceptable product(s):

1) Rosco Stainless Steel Gobos

8. Pattern Template Holders

a. Provide stainless steel metal pattern holders with plastic pull ring
b. Quantity:

1) (8) size B
2) (8) size M

c. Acceptable product(s):

1) City Theatrical 2160 and 2165 sandwich holders
2) Electronic Theatre Controls 400PH-B and 400PH-M pattern holders

9. Side Arm Extensions

a. Provide side arms for extending the mounting point of theatrical fixtures beyond rigging pipes and handrails.
b. Side arm to consist of:
c. Hanging attachment for connection to 1.5” schedule 40 batten or handrail.
d. Pipe extension of 18”
e. One or more sliding tees for attaching theatrical fixtures to pipe extension
f. Color: black
g. Quantity: (18)
h. Acceptable product:

1) Altman Lighting 509-HD-24-1 Side Arm

10. Tie Line

a. Product will be a cotton line with polyester core
b. The blend will be a diamond braid construction
c. Product will be Black in color
d. Product will be unglazed
e. Product will be 1/8” in diameter
f. Product will be on original spool or reel
g. Provide 600’-0” spool

1) Cut into 24” ties for dressing cable used in repertory plot
2) Furnish the remainder of unused spool to Owner

h. Quantity: (2)
i. Acceptable product:

1) Rose Brand #4 Tie Line

11. Light Trees:

a. Provide code rated parts to comprise a lighting tree.
b. Pipe and base will be furnished in black finish.
c. Provide six (6) light tree assemblies as follows:
d. Provide a 50lb. base NPT threaded to accept a typical 1-1/2” Schedule 40 pipe.
e. Provide a 10’-6” section of 1-1/2” Schedule 40 pipe (threaded on both ends) with plastic vinyl end cap.
f. Provide total three (3) – 35 pound sandbags for each tree.
g. Acceptable product:

1) Base: Altman B50.
2) Or approved equal

12. Side Arms:

a. Provide total of eighteen (18) – 18” sliding tee side arms (three) for each light tree.
b. Furnished in black finish.
c. Acceptable product:

1) Altman 18in. Sidearm with One Tee
2) Or approved equal

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. The installation recommendations contained within the Telecommunications Distribution Methods Manual are mandatory rpmum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place.

E. Verify all locations of equipment in all rooms with Owner’s Representative, Owner, and Consultant.

3.2 INSTALLATION OF CABLE AND WIRING

A. Verify installation of electrical work for this scope and all associated equipment with the overall Electrical installation. Provide all necessary equipment, including mounting hardware, for complete connection of power system wiring.

B. Verify installation of power and ground wiring to equipment. Power and ground wiring will terminate inside of equipment and/or junction boxes and be hardwired to ground buss and circuit breaker to ensure uninterrupted operation.

C. All control wiring will be executed in adherence to ANSI standards including the following:

1. Isolate cables carrying signals at different levels and separate to restrict interaction.
2. Keep wiring separated into three groups of conduit provided for control circuits, power circuits (up to 50 Amps), and feeder circuits (above 50 Amps).
3. Isolate all wiring, except for safety ground wiring, from conduit ground.
4. Take such precautions as are necessary to prevent and guard against electromagnetic and electrostatic interference in other technical systems (such as sound and communications systems) in the facility. Where possible all devices and wiring will be enclosed in a shielded environment. Take care not to use shields (conduits) and grounds as current carrying return paths for lamp and relay coil commons. All ground references are to be made to the building electrical system ground.
5. Label unused wiring provided for spares or future systems and terminate at screw terminal strips.
6. All joints and connections will be made with resin-core solder or with ratchet jaw crimp type mechanical connectors. Connect all circuits electrically in phase using same wire color code for similar circuits throughout the project.
7. Install cable in a manner to adhere to manufacturer’s specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
8. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
9. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
10. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
11. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
12. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
13. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
14. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered ‘splice’ points.
15. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRN nylon grommetting.
16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.

3.3 INSTALLATION OF EQUIPMENT

A. Take appropriate precautions against electrostatic discharge (ESD) when installing electronic equipment.

B. Equipment to be installed in new condition, free of damages, scratches, dents, etc.

C. Provide adequate ventilation in cabinet mounted equipment to maintain operating temperatures within range recommended by Manufacturer.

D. All equipment will be installed in compliance with applicable Local and National Codes and Regulations.

E. Equipment shall be installed in accordance with Manufacturer's requirements.

F. Install lighting fixtures using standard industry practices. All lamps, lenses, and reflectors will be installed free of dirt, dust, and finger smudges. Do not use bare hands when handling conventional tungsten lamps. Ensure that a safety cable is properly applied with each fixture.

G. Install lighting instruments to the standard house hang or repertory plot as directed by Consultant. Contractor shall document location of each type of distribution device and circuiting as part of as-built documents on plot. Provide pdf copy of plot to Consultant and Owner. Provide (2) full size printed copies of plot to Owner.

3.4 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the System ensure the following:

1. Physical installation is complete.
2. Products are installed in proper and safe manner according to Manufacturer's requirements.
3. Dust, debris, solder splatter, etc. is removed.
4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
5. Temporary facilities and utilities have been properly disconnected and removed.
6. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. The jobsite shall be broom clean.

B. Contractor shall:

1. Retain the services of a Manufacturer certified technician to check the installation and ensure its proper operation. No part of the Theatrical Lighting System may be energized before this technician has checked and approved the System installation.
2. Test all lighting load circuits for the following:
    a. Continuity
    b. Nominal voltage
    c. Polarity
    d. Accuracy to the Distribution Schedule as enumerated in the drawings.
3. Test controls wiring for the following:
    a. Appropriate wire types and quantities
    b. Control wire distance from source
    c. Terminations meet Manufacturer requirements

C. The following identifies some, but not all, of the commissioning tasks of the commissioning team. This list is not intended to be comprehensive and should be considered a general guideline for the Contractor without a defined commissioning process statement:

1. Program all power distribution panels
2. Setup and program all network control devices
3. Setup and initial programming of control console
4. Setup and initial programming for all architectural control devices

5. Program all emergency lighting control devices

3.5 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Consultant.

B. Testing will include operation of each major system and any other components deemed necessary. Contractor will assist in this testing and provide all test equipment noted below. Contractor shall provide at least two (2) technicians available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications. Testing process is estimated to take a minimum of one (1) day.

C. Provide the following test gear:

1. Circuit Tester with adapters for all connectors present in the system.
2. Multimeter capable of measurements up to 600V AC/DC, 10A DC, and 2MOhms
3. DMX Tester
4. Industrial Ethernet Tool capable of testing signal continuity and distance from source

D. The following procedures will be performed on each System:

1. Observation of the physical installation including labeling, mounting, and finish of all equipment and components which are a part of the System.
2. Functional testing of all control devices and devices under control within the System.
3. Review of programming and standard settings for all control interface devices.
4. Load circuit verification.
5. Control circuit verification.
6. Other tests on equipment or systems deemed appropriate.

E. The Consultant will provide the Owner with a listing describing any incomplete or otherwise deficient items determined as part of the testing process. Where further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is complete.

3.6 INSTRUCTION OF OWNER PERSONNEL

A. Provide operations and service training on all equipment incorporated in the System.

B. Training shall not be conducted until final observation and testing is completed by the Consultant, unless otherwise directed by the Owner.

C. Provide (12) hours of training. Training time shall be conducted in multiple sessions, with each session not to exceed four hours. Training shall be conducted in accordance with Owner’s schedule.

1. Six months after completion of initial training, schedule an additional (4) hours with Owner for review of systems and equipment operation.

D. The major equipment components and subject matter are as follows (advisory percentage of overall time allocated):

1. Power Distribution System (20%)

a. Basic testing and control
b. Normal and emergency operations

c. Programming memory
d. Software configurations and upgrades
e. Troubleshooting.

2. Control Console (40%)

a. Operational training, including offline or remote-access software
b. Patching and programming
c. Fixture integration
d. Peripheral hardware
e. Applications interface for retrieving information from the control console
f. Troubleshooting
g. Upgrades

3. Architectural Controls (20%)

a. Part of training will be to establish programmed looks for the performance areas with the end-user. The Contractor shall provide all equipment to establish DMX values for preset looks.
b. Snapshotting preset onto DMX controller
c. Preset recall operation
d. Normal operations (e.g., console arbitration, time-clock controlled events, etc.)
e. Troubleshooting.

4. Theatrical Lighting Fixtures and Accessories (20%)

a. Hang and focus
b. Cabling and circuiting
c. Setup and DMX addressing
d. Troubleshooting

E. Training Schedules

1. Training should be assumed to take place on the project site.
2. Training should be scheduled to be non-overlapping.
3. Actual training schedule shall be by agreement with Owner.
4. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.

F. Submit an outline of the course with sample instructional aides for approval thirty (30) days prior to scheduled instruction sessions to architect and architect’s consultant.

G. Following discussions with Owner, provide a Training submittal 2-4 weeks prior to first training. Submittal shall:

1. Include a separate page/entry for every training session.
2. Indicate date, time, and approximate length of training session.
3. Indicate person(s) conducting training.
4. Indicate whether training will be video recorded.
5. Intended curriculum and most appropriate attendees (e.g., technician, operations, IT, etc.)
6. Include signature and title lines for:

a. Owner acknowledging and accepting training schedule. Include both an Accepted and Rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
b. Countersigning by trainer indicating that training actually occurred.
c. All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner’s representative attending training.
d. Owner’s representative attending training at the end of the session shall initial that:

1) Training Occurred.
2) Training Materials were provided and left with Owner

3) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
4) Training was generally sufficient for the proposed curriculum.

7. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)

H. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

3.7 EVENT ATTENDANCE

A. Contractor shall attend the first facility use or event as directed by the Owner.

1. Event Attendance includes the following requirements:

a. Attendance shall begin at the first crew call and conclude when the crew is released. During these events perform such tasks (e.g., assistance with patching, programming, troubleshooting cabling problems, etc.) as requested by User. Tasks shall be strictly assistance, not operation.
b. Event support personnel shall be a technician associated with the original installation and commissioning.
c. In the event that the system is used prior to final acceptance, attendance in support of system usage shall not be construed as acceptance or as event attendance.

2. Coordinate these schedules with the Owner.

END OF SECTION 11 61 62

SECTION 11 90 00 – MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following types of equipment as indicated in the Drawings and specified herein:
   1. Wall-mounted ballet barres.

B. Related Sections:
   1. Section 05 50 00 – Metal Fabrications: Secondary steel supports as required.
   2. Division 5 Sections: Overhead building structure Division 26 Sections: Final electrical connections.

1.2 QUALITY ASSURANCE

A. Installation provided only personnel who are skilled in the work required.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product data on physical characteristics, electrical characteristics, and plumbing characteristics for each type of equipment and accessory specified.

1.4 PRODUCT HANDLING

A. Protection: Protect equipment before, during and after installation. Protect installed work of other trades.

B. Replacements: In event of damage, make necessary replacements.

PART 2 - PRODUCTS

2.1 PRODUCTS:

A. FLOOR-MOUNTED BALLET BARRES:
   1. Manufacturer:
      a. American Harlequin Corp., www.harlequinfloors.com , 800-642-6440.
      b. Substitutions: Section 01 60 00 - Product Requirements.
   2. Model: *Wall-Mounted Single Ballet Barre* as manufactured by Harlequin.
      a. Black factory powder coat finish.
      b. Height: Indicated on drawings.
      c. Mounting Flanges: Provide steel flanges with predrilled holes for (4) 1/4”-3/8” diameter lag screws.
      d. Barres: Nominal 2” diameter white maple dowels sanded smooth with no finish. Lengths shall be 96” for supports at 48” centers.
   3. Layout: Install system in front of mirrored walls as indicated in the drawings. Confirm with Architect location of wall supports relative to mirror joints. .

2.2 EXECUTION

2.2 INSPECTION: Inspect installed work of other trades and verify that such work is complete to a point where this work may commence. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

A. Verify that manufacturer’s recommended power is installed, and with correct receptacle configuration without adaptor.

B. Discrepancies: In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.

2.3 BALLET BARRES:

A. Locate wall brackets at mirror joints. Keep ends of barres nominal 12” from any end walls running perpendicular to run of barres. Extend barres no greater than 8” beyond end supports.

B. Bolt wall brackets to solid wood blocking between studs using minimum ¼” lag screws. Install lag screw at every factory-drilled hole in mounting plates.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Horizontal aluminum slat louver blinds and operating hardware.

B. Related Sections:
1. Section 08 11 13 - Standard Steel Doors and Frames: Steel window frames receiving louver blinds.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts: Aluminum storefront frames receiving louver blinds.
3. Section 12 24 13 – Roller Shades.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data: Submit product data indicating physical and dimensional characteristics, operating features, and available finishes.

C. Samples:
1. Submit two samples of louver slat, 12 inches long, illustrating materials and finish color.
2. Submit one full-size unit, not less than 16 inches wide by 24 inches long. Approved sample may be incorporated into the Work.

D. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
1. Methods for maintaining horizontal louver blinds and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
3. Operating hardware.

1.3 QUALITY ASSURANCE

A. Obtain all horizontal louver blinds from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Resistance Ratings: Passes NFPA 701.

C. Corded Window Covering Product Standard: Provide horizontal louver blinds complying with WCMA A 100.1.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 PROJECT CONDITIONS

A. Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hunter Douglas Window Fashions www.hunterdouglas.com
B. Levolor Contract; www.levolor.com
C. Springs Window Fashions Division, Inc.; Bali www.springs.com
D. Springs Window Fashions Division, Inc.; Graber. www.springs.com
E. Substitutions: Section 01 60 00 - Product Requirements Not permitted.

2.2 COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

B. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
1. Width: 1-inch.
2. Thickness: 0.008 inch minimum.
3. Color: As indicated on Drawings.

C. Slat Support: Woven polypropylene cord, ladder configuration.

D. Headrail: Pre-finished, formed steel or extruded aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
1. Color: Same as slats.

E. Bottom Rail: Pre-finished, formed steel or extruded aluminum tube, sealed with plastic or metal capped ends, with top side shaped to match slat curvature.
1. Color: Same as headrail.

F. Control Wand and Tilt Control: Consisting of enclosed, permanently lubricated worm gear mechanism and linkage rod, for the following operation:
1. Tilt Operation: Manual with non-removable clear plastic wand.
2. Length of Tilt Control: Length required to make operation convenient from floor level.
3. Tilt: Full.

G. Lift Cord: Braided polypropylene, with lock to stop blind at any position in ascending or descending travel.

H. Valance: Manufacturer's standard.
1. Finish Color Characteristics: Match color, texture, pattern, and gloss of louver slats.

I. Mounting: Method permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment.
1. Provide intermediate support brackets if end support spacing exceeds spacing

recommended by manufacturer for weight and size of blind.

J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, installed where indicated.

2.3 FABRICATION

A. Comply with AWCMA Document 1029, unless otherwise indicated; each horizontal louver blind shall be self-leveling and consist of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.

B. Fabricate blinds to fit within openings as follows:
1. Blind units installed between (inside) jambs, or at openings requiring a single blind unit: Width equal to the jamb-to-jamb dimension of the opening, less 1/4 inch per side or 1/2-inch total.
2. Blind units installed outside jambs, or at openings requiring multiple blind units: Width and length as indicated, with terminations occurring 1/4” from centerlines of mullions.
3. Prior to issuing submittals, verify with Architect whether blinds should be located within the window frames or outside of the frames. Requirements may vary within the Project due to configurations of frames.

2.4 FINISH

A. Aluminum: For aluminum components exposed to view, apply manufacturer's standard baked enamel finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

B. Components: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive work.

C. Verify structural blocking and supports are correctly placed.

3.2 INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions. Install intermediate headrail support where required to prevent headrail deflection.
1. Control wands or cords for blinds at higher window sections shall not extend onto blinds of lower windows below.
2. Allow clearances between for window operating hardware, if any.

B. Secure in place with flush countersunk fasteners.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust blinds for smooth operation.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 12 32 16 – MANUFACTURED PLASTIC LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Plastic laminate-clad cabinets and countertops assembled from stock components.
2. Plastic laminate-clad cabinets and epoxy countertops assembled from stock components at Art Rooms.

B. Related Sections:

1. Section 06 10 53 - Miscellaneous Rough Carpentry: Miscellaneous grounds and support framing.
2. Section 06 20 23 - Interior Finish Carpentry and Millwork: For miscellaneous items of custom millwork not provided under this Section.
3. Section 07 90 00 – Joint Protection: For requirements of sealant used at interface of casework and other materials.
4. Section 08 71 00 - Door Hardware: Cylinders for cabinet locks.
5. Section 08 80 00 - Glazing: Requirements for casework glazing.
6. Division 22 - Plumbing: Stainless steel sinks and related fittings for all casework countertops, including epoxy tops at Art Rooms

1.2 REFERENCES

A. Architectural Woodwork Institute:

1. AWI - Quality Standards Illustrated.

B. Federal Specification Unit:

1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

C. National Electrical Manufacturers Association:

1. NEMA LD 3 - High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Submit data for each type of casework unit and hardware accessory.

D. Samples:

1. Submit two samples, 6 x 6 inches in size, of each laminate finish.
2. Submit two samples, 6 x 6 inches in size, of epoxy resin countertop material in specified color.
3. Submit one full size sample of a typical base cabinet unit, complete with doors, drawers, and hardware, but without countertop.
4. Submit one full size sample of a typical wall cabinet unit, complete with doors, shelves, and hardware.
5. Approved samples may be incorporated into the Work. If not incorporated into the Work, retain approved samples in building until completion of the Work and remove when directed by Architect.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom Grade.

B. Single Source Responsibility: All casework, countertops, and accessories furnished under this Section shall be supplied by a single manufacturer.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum three years' experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect units from moisture damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

1.9 WARRANTY

A. Provide manufacturer's written warranty for defects in materials and workmanship including but not limited to casework becoming unserviceable or causing an objectionable appearance, rough or difficult operation, loose or missing parts, delamination of surfaces, noticeable deterioration of finish, warped or misaligned surfaces, or telegraphing of sub

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE-CLAD CASEWORK

A. Manufacturers:
1. A&M Casework, Inc.
2. Calmar Manufacturing Co. Inc.; Calmar, Iowa
3. Case Systems, Inc., www.casesystems.com
4. Casework Services Inc www.caseworkservices.com.
5. Global Casework Manufacturing, Inc., www.globalcasework.com.
6. Imperial Mill & Fixtures, Inc.
7. JC Millwork, Inc., www.jccompany.org.
8. Jericho Woodworks, www.schoolcasework.com.
9. Jim R. Reynolds & Associates, Inc., www.jimreynolds.com
10. MGC, Inc., www.mgcinc.net.
11. South Texas Woodmill, Inc.
12. Terrill Manufacturing, Company; San Angelo, Texas. www.terrillmfg.com
13. TMI Systems Design Corp.; Dickinson, ND www.tmisystems.com
14. Top Notch Cabinets and Installation, www.topnotch@aol.com
15. Victoria Cabinet Works; Victoria, Texas
16. Westmark Commercial Case Work, Houston, Texas www.westmarkproducts.com
17. Substitutions: Section 01 25 00 – Substitution Procedures

B. Definitions: The following definitions apply to plastic laminate-clad casework:

1. Exposed portions of casework (Finish Surfaces) include surfaces visible when doors and drawers are closed. Bottoms of cases more than 4'-0" above floor, tops of cases less than 6’-6” above floor, and visible members in open cases or behind glass doors shall be considered exposed.
2. Semi-exposed portions of casework includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of cases 6'-6" or more above floor shall be considered semi-exposed.
3. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

2.2 COMPONENTS

A. Lumber: AWI Custom Grade; maximum moisture content of 6-8 percent.

B. Core Material: AWI Grade B; veneer core, shop sanded; glue contains no urea-formaldehyde.
1. Furnish 7-ply veneer plywood for 3/4 inch thickness.
2. Furnish 5-ply veneer plywood for 1/2 inch thickness.
3. Furnish marine grade at sink cabinets.

C. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets; color, pattern, and surface texture as scheduled per Arborite, ARPA, Formica, Nevamar, Pionite, or Wilson Art.
1. Provide 0.050 inch thick material at horizontal surfaces, and 0.030 inch thick laminate on exposed vertical surfaces.
2. Provide backing sheet on bottom or concealed surfaces. Color(s) to be selected by the Architect from manufacturer’s full range.

D. Epoxy Resin Countertops:
1. Basis of Design: *Durcon* as manufactured by WilsonArt, www.durcon.com.
2. Size: 1-inch thick x one-piece lengths for tables and maximum practicable lengths with hairline joints for countertops.
3. Cast Epoxy Resin: Factory molded tops of modified epoxy resin chemical-resistant formulation, uniform mixture throughout full thickness. 14,000 psi compressive strength.
4. Color, non-glare black.

E. Reference 2.4 Fabrication and 4.1 Typical Components Diagram for clarification of component types and locations. Where diagram may differ from these specifications, diagram shall govern.

2.3 ACCESSORIES

A. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive.

B. PVC Edge Trim: Extruded rigid PVC; smooth finish, of width to match component thickness; standard or custom color as required to match plastic laminate; 1 mm thickness at doors and drawers; 3 mm thickness at countertops.

C. Glass: Clear tempered double strength, as specified in Section 08 80 00.

D. Fasteners and Anchors:
1. Fasteners: Hot dipped or Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

F. Concealed Joint Fasteners: Threaded steel.

G. Grommets: Metal material for cut-outs.

H. Hardware: Manufacturer's standard commercial-quality, heavy-duty hardware complying with requirements indicated, constructed with base materials and finishes as selected from manufacturer’s full range of standard materials and finishes.
1. Butt Hinges: Semi-concealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, constructed from minimum 0.095-inch tempered steel, with antifriction bearings and rounded tips.
a. Provide minimum 170º door swing.
b. Provide 2 hinges for doors less than 48 inches high and 3 hinges for doors 48-inches or more.
2. Pulls: Solid metal, for drawers and swing doors, mounted with 2 screws fastened from back. For sliding doors, provide recessed flush pulls. Provide 2 pulls for drawers over 24" wide.
3. Door Catches: Dual self-aligning permanent magnet type. Provide 2 catches on doors over 4 ft. high.
4. Drawer Slides:
a. Light and Medium Duty Drawers: Accuride 3832, KV 8400 or approved equivalent. Full extension all ball bearing 100 lbs. load rated with lever disconnect and positive outstop preventing inadvertent drawer removal.
Or:
b. 100-pound load rated epoxy powder coated steel, bottom corner mounted with smooth, quiet nylon rollers. Positive stop in both directions and self-closing feature.
5. File Drawer and Wide Heavy Duty Drawers:
a. Accuride 4032, KV 8400 or approved equivalent. Full extension all ball bearing 150 lbs. load rated with rail mount, hold-in detent, progressive movement and positive outstop preventing inadvertent drawer removal.
b. File hanger rails: Steel or aluminum, no plastic.
c. Label Holders: Provide Where Indicated, Size To Receive Standard Label Cards Approximately 1” X 2” Nominal Size, Finished To Match Other Exposed Hardware.
6. Drawer and Door Locks: Half-mortise type, dead bolt, brushed chrome or stainless steel finish; designed for keyed core provided under the Hardware Section.
a. Provide with metal strike. All casework locks within a room keyed alike, each room keyed differently.
b. Provide 2 keys per room for rooms with casework locks. Lock and keys stamped or engraved with matching numbers.
7. Sliding Door Hardware Sets: Where indicated, use manufacturer’s standard to suit type and size of sliding door units.
8. Cabinet Base: Resilient base, type specified in Section 09 65 00. Provide on exposed sides, fronts, and backs of floor-mounted cabinets.
9. Adjustable Shelf Supports: BHMA B84073, wrought steel, mortise-mounted or Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on approximately 1.375 inch centers.
a. Each shelf support to have two integral support pins, 5mm minimum diameter, to interface predrilled holes and to prevent rotation of support. Provide four supports per shelf.
b. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving.
c. Supports shall be designed so that they may be field fixed if desired. Structural load to 1200 pounds without failure (300 pounds per support).

2.4 FABRICATION

A. General Cabinet Requirements:
1. Cabinet floor bases shall be fabricated from fire-retardant Southern Yellow Pine or Douglas whether exposed, concealed, or surfaced with finish materials.

2. Frames and structural parts of cabinets shall be fabricated from 7-ply wood veneer plywood or lumber.
3. Face, side, and divider panels shall have cores fabricated from minimum 3/4 inch thick 7-ply wood veneer plywood.
4. Back panels shall be fabricated from minimum 1/2 inch thick wood veneer plywood.
5. Doors, shelves, drawer fronts, and tall cabinet tops shall have cores fabricated from minimum 3/4 inch 7-ply wood veneer plywood.
6. Drawer sides and bottoms shall be fabricated from sealed hardwood lumber.

B. Laminate Cladding:
1. Countertops and splashes: GP50.
2. Exposed surfaces other than countertops and splashes: GP28.
3. Semi-exposed surfaces: CL20.
4. Concealed faces of exposed and semi-exposed surfaces: CL20 or BK20; all laminated construction shall be balanced and edge banded.

C. Edge Banding:
1. Countertops and splashes: PVC, 3mm.
2. Doors, shelves, drawer fronts, and face frames of open shelving units: PVC, 3 mm.
3. Face frames other than open shelving units, and tops and bottoms of drawers: PVC, 1 mm.

D. Countertop Construction:
1. Size: Maximum practicable lengths.
2. Finished Thickness: 1-1/4 inch; provide front and end overhang of 1 inch over base cabinets.
3. Rounded Corners: Provide min. 1 inch radius at all outside corners.
4. Plastic Laminate: Shop-bond with waterproof adhesive to 1-1/8 inch thick wood veneer core plywood.
   a. At countertops with sinks or other plumbed fixtures, use only marine grade plywood full width of the sink plus 12” to either side.
   b. Apply backing sheet to underside of countertop.
   c. Edge exposed edges of countertop and openings with 3mm cushioned vinyl edging.
5. Splash: Construct splashes of 3/4 inch thick 7 ply wood veneer core plywood.
   a. Use marine-grade plywood at sink cabinets.
   b. Edges finished and edge banded with same plastic laminate used for countertops.
6. At epoxy resin tops provide front and end overhang of 1 inch over base cabinets, formed with continuous drip groove on under surface 1/2 inch from edge. Cast surfaces with completely smooth finish, with factory cut-outs for sinks (obtain sink templates the Plumbing contractor) and drip grooves.

E. Shop-assemble casework for delivery to site in units easily handled and to permit passage through building openings.

F. Door and Drawer Fronts: Flush overlay style.

G. Fit exposed edges with PVC edging. Use one piece for full length only.

H. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

I. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners Locate counter butt joints minimum 2-feet from sink cut-outs.

J. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

K. Fabricate cabinets and counter tops with cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions.

L. Shop glaze glass materials using Interior Dry method specified in Section 08 80 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Set and secure casework in place; rigid, plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units, counter tops, and splashes.

C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

D. Base Cabinets:
1. Fasten each individual cabinet to floor at toe space, with fasteners spaced 24 inches o.c. Bolt continuous cabinets together. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets.
2. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

E. Wall Cabinets:
1. Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets.
2. Reinforcement of stud walls to support wall-mounted cabinets will be performed during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this Work.

F. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

G. Countertops:
1. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no job site processing of top and edge surfaces.
2. Fastenings: Use concealed clamping devices for field joints, located within 6 inches of front, at back edges and at intervals not exceeding 24-inches. Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with zee-type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.
3. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices.
4. After installation, carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.
5. Provide holes and cutouts as required for mechanical and electrical service fixtures.
6. Provide scribe moldings for closures at junctures of top, curb and splash with walls

as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.

7. Seal space between countertop backsplash and wall with sealant as specified in Section 07 90 00.

H. Accessories: Install in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust moving or operating parts to function smoothly and correctly.

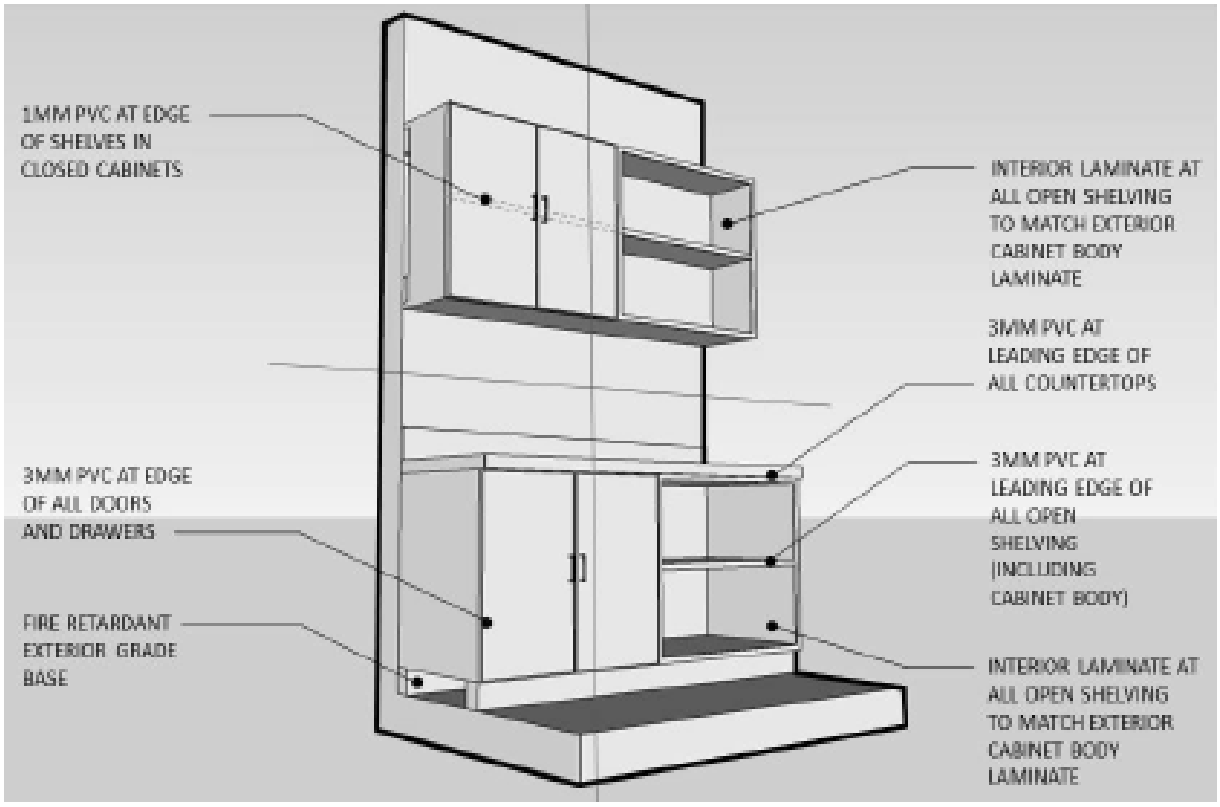
3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

PART 4 - DIAGRAMS

4.1 TYPICAL COMPONENTS DIAGRAM



END OF SECTION

SECTION 12 35 00 – MANUFACTURED MUSICAL INSTRUMENT STORAGE CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Musical instrument storage cabinet systems as indicated.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking for anchoring musical instrument storage cabinets.

1.2 REFERENCES

A. American Laminators Assoc. Performance Standard ALA 1985.

B. ANSI - BHMA Standard A156.9, Grade 1.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication and installation details for musical instrument storage cabinets. Include plans, elevations, sections, details, and attachments to other Work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of musical instrument storage cabinet manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain musical instrument storage cabinets through one source from a single manufacturer.

C. Product Designations: Drawings indicate sizes, configurations, and finish material of musical instrument storage cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' cabinets of similar sizes and door configurations, of same finish material, and complying with the Specifications may be considered.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver musical instrument storage cabinets only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate cabinets have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

C. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of institutional cabinets that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Delamination of components or other failures of glue bond.
   2. Warping of components.
   3. Failure of operating hardware.

4. Deterioration of finishes.

C. Warranty Period: Three years from date of Substantial Completion.

D. Warranty Period for Cabinet Shelving: Ten years from date of Substantial Completion.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install musical instrument storage cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where musical instrument storage cabinets are indicated to fit to other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating musical instrument storage cabinets without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate layout and installation of metal framing and reinforcements in gypsum board assemblies for support of musical instrument storage cabinets.

1.9 SYSTEM DESCRIPTION

A. Design Requirements:
1. Provide one-piece high molecular polyethylene shelving with integral ventilation grooves, designed and engineered to withstand continuous use without surface or front edge breakdown.
2. Individual cabinets shall be manufactured with thermofused polyester laminated panels, finish both faces all components. All end panels to be factory jigged and drilled to accept unit-to-unit through-bolting: no conventional wood screws attaching units side-to-side will be permitted. Each cabinet will be furnished with an integral base and four (4) steel levelers accessible from within the unit but concealed in final installation.
a. Provide wire grille hinged door panels as indicated the drawings. All hinges shall be structurally attached to vertical panels using engineered and tested through-bolt hardware that is welded to wire grille doors. Screw-mounted hinges not acceptable.

B. Manufacturer to Provide Documentation of Following Minimum Performance Requirements:
1. Molded plastic instrument storage shelf shall have a static load capacity of 1,000 lbs.
2. Wire grille door hinge to be welded to door frame in five places, pull-tested to withstand 3,000 lbs.

PART 2 - PRODUCTS

A. MUSICAL INSTRUMENT STORAGE CABINETS
1. Manufacturers:
a. Melhart Music, www.melhart.com
b. Stephens Industries Inc., www.stevensind.com
c. TMI Systems Design Corp., www.tmisystems.com
d. Wenger Corp., www.wengercorp.com
e. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Cabinet Wall Panels:
1. 3/4-inch thick industrial (cabinet) grade particleboard, minimum 48 pcf with thermoset polyester (melamine not acceptable) laminate on both sides for totally finished construction. No backer sheets or unfinished surfaces may be used on unexposed sides. Color: As selected by Architect from manufacturer's full line of standard and custom colors.
a. Interior Composite Wood Products: No added urea-formaldehyde resins.

B. Cabinet Shelving:
1. Cabinets up to 27 inches wide: One-piece high molecular blow-molded polyethylene with 1-3/- inch radius front edge. Mount to cabinet walls with one-piece molded rigid ST nylon clip. Shelf is replaceable without damage to adjacent surfaces. Doweled shelves will not be permitted.
2. Cabinets over 27 inches wide: One-piece high molecular formed polyethylene with radius front edge and 3/16" wall thickness. Ribbed for structural integrity. Supported by four structural tubular members 1-1/2" x 1" x 16 ga. wall thickness with 14 gauge welded end plates.

C. Doors:
1. Grille doors: Welded steel grille construction with powder coat finish, color as selected by Architect from manufacturer's full line of standard and custom colors. Welds at T-joints must be 360º.
a. Hinges, 5-knuckle institutional type hinge, supplied by ISO 9002 vendor. Hinge will support 315 lbs. dynamic vertical load. Hinge pin shall be 2-3/4" long. Hinge welded to door frame in five places.
b. Finish: Manufacturer's standard powder coat. Provide two hinges on compartment doors, four on full height doors.
2. Locking slide-bolt: All doors shall be provided with locking slide-bolt designed for padlocks, with formed steel strike plate through-bolt connected to cabinet end panel; 12-gauge steel. Provide clear plastic label holder for identification card insert. Finish: Manufacturer's standard powder coat.
3. Edging: Heat bonded 3mm beveled PVC edge-banding, machine applied using hot-melt adhesives, edges and corners machine profiled for safety, integral color to match door panels.

D. Finish Hardware:
1. Joinery Hardware: Two inch, 1/4-20 panel connectors with 15 mm head diameter, and steel thread inserts shall be utilized to join desired cabinets side-to-side; use factory jigged and drilled joinery holes.
2. Finish: Manufacturer's standard powder coat.
3. Cabinet levelers: Structural levelers each cabinet, accessible from within the unit when desired, concealed in complete installation; glides with minimum 3/8 inch diameter threaded rod mounted in steel corner brackets. Provide minimum four glides per cabinet, six glides for cabinets with divider panels.

E. Cabinet Back Panel: Standard cabinet back to be 1/4" thick prefinished hardboard, color: match interior of side and top panels.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

F. Vertical Closure Kit: Provide visual closure between wall and cabinet. Constructed of 3/4" thick thermoset polyester composite wood to match cabinet side panels.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

G. Horizontal Closure Kit: Provide visual closure between top of cabinet and soffit. Constructed of 3/4" thick thermoset polyester composite wood to match cabinet side panels.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

H. Top Back Filler Kit: Provide visual closure between back wall and top panel of cabinet.

Constructed of 3/4" thick thermoset polyester composite wood to match cabinet top panels.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

I. Finished Back Panel: Provide panel to attach to cabinet back that is exposed. Constructed of 1/2" thick thermoset polyester composite wood to match cabinet.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

J. Base Molding: ASTM F 1861, Type TS (rubber, vulcanized thermoset), black, 4 inches high. Provide on fronts and exposed sides of floor-mounted cabinets.
1. Style: A, straight with no toe.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of musical instrument storage cabinets.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CABINETS INSTALLATION

A. Install plumb, level, and true; shim as required, using concealed shims. Where musical instrument storage cabinets abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

C. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips; No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish; or toggle bolts through metal backing or metal framing behind wall finish.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises, unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
1. Adjust cabinets and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6 mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

SECTION 12 35 51 – MUSIC LIBRARY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shop manufactured pull-out storage systems specifically designed and manufactured for the storage of sheet music.

1.2 REFERENCES

A. American Laminators Assoc. Performance Standard ALA 1985.

B. ANSI - BHMA Standard A156.9, Grade 1.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication and installation details for musical library system storage units. Include plans, elevations, sections, details, and attachments to other Work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of system manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain music library system through one source from a single manufacturer.

C. Product Designations: Drawings indicate sizes, configurations, and finish material of frame, storage cabinets, hardware, and accessories by referencing designated manufacturer's catalog numbers. Other manufacturers' systems of similar sizes and configurations, of same finish material, and complying with these Specifications may be considered.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver music library system only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate cabinets have been completed in installation areas. If system must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

C. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's ten-year written warranty agreeing to repair or replace components of system frame, cabinets, or accessory parts that fail in materials or workmanship. Failures include, but are not limited to, the following:
   1. Delamination of components or other failures of glue bond.
   2. Warping or sagging of components.
   3. Failure of operating hardware.
   4. Deterioration of finishes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install system until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where field measurements cannot be made without delaying the Work, coordinate dimensions with the Contractor to ensure that actual dimensions correspond to established dimensions.

1.8 SYSTEM DESCRIPTION

A. Cabinets fabricated with 3/4” thick industrial grade composite wood with no added formaldehyde and thermos-fused polyester laminated finish.
   1. Overall Closed Dimensions: 16” wide x 44a: deep x 92-1/2” high (7-shelf unit).
   2. Finish both faces all cabinet components. No backer sheets or unfinished surfaces may be used on unexposed sides or edges.
   3. Back panel designed to fit on either side of unit for left or right hand use.
   4. Each cabinet furnished with four adjustable shelves and three fixed shelves, all reinforced with aluminum extrusion that includes slot with vinyl labeling material.
   5. Provide cabinets with bumpers for control of side and outward movement.
   6. Each cabinet furnished with four 8-inch diameter casters for pull-out access. Casters concealed behind face of raised cabinet base.
   7. Frame shall be 1” x 1” x 16-gauge tubular steel with welded connections.
      a. Factory-applied black enamel finish.
      b. Steel floor plates at vertical cabinet standards for permanent anchorage to floor slab.
      c. Standard anchorage plates for fastening frame to wall in addition to floor anchorage.
   8. Accessories Provided:
      a. Top closure constructed of 3/4” plywood with polyester laminate finish to match cabinets.
      b. Hasps for Owner-provided padlock.
      c. Through-bolted pull handles.
      d. ID label on face of each cabinet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Case Systems, Inc., www.casesystems.com
B. LSI Corporation of America, www.lsi-casework.com
C. TMI Systems Design Corp., www.tmisystems.com
D. Wenger Corp., www.wengercorp.com
E. Melhart Music, www.melhart.com
F. Substitutions: Section 01 60 00 - Product Requirements.

2.2 SYSTEM DESCRIPTION

A. Basis of Design: Music Library System as manufactured by Wenger or approved equivalent by specified manufacturer.

B. Cabinets fabricated with 3/4” thick industrial grade composite wood, minimum 48-pcf, with no added formaldehyde and thermos-fused polyester laminated finish.
   1. Overall Closed Dimensions: 16” wide x 44a: deep x 92-1/2” high (7-shelf unit).
   2. Finish both faces all cabinet components.
   3. Back panel designed to fit on either side of unit for left or right hand use.
   4. Each cabinet furnished with four adjustable shelves and three fixed shelves, all reinforced with aluminum extrusion that includes slot with vinyl labeling material.

5. Provide cabinets with bumpers for control of side and outward movement.
6. Each cabinet furnished with four 8-inch diameter casters for pull-out access.
7. Frame shall be 1” x 1” x 16-gauge tubular steel with welded connections.
   a. Factory-applied black enamel powder coat finish.
   b. Steel floor plates at vertical cabinet standards for permanent anchorage to floor slab.
   c. Standard anchorage plates for fastening frame to wall in addition to floor anchorage.
8. Accessories Provided
   a. Top closure constructed of 3/4” plywood with polyester laminate finish to match cabinets.
   b. Hasps for Owner-provided padlock.
   c. Through-bolted pull handles.
   d. ID label on face of each cabinet.
9. Laminate Color(s): As selected by Architect from manufacturer’s full line of standard and custom colors

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances, location of wall anchorage reinforcements, and other conditions affecting operational performance and safety of installed music library system.

1. Proceed with installation only after any unsatisfactory conditions have been corrected.

2. Proceeding with installation indicates acceptance of all existing conditions and substrates.

3.2 SYSTEM INSTALLATION

A. Install frame plumb, level, and true; level as required using concealed shims.

1. Anchor floor plates to concrete slab using 3/8” diameter stainless steel expansion bolts.

2. Where music library system abuts finished walls, apply narrow filler strips and scribe to wall for accurate fit. Conceal all wall fasteners and anchorages.

B. Storage Cabinets: Set cabinets straight, level, and plumb. Adjust all adjacent tops within 1/16 inch of a single plane. Adjust bumpers and guides for proper open, closed, and traveling positions.

C. Install pulls, ID frames, and hardware uniformly and precisely. Adjust and align locking hasps so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

D. Lubricate casters for smooth and noiseless operation.

3.3 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil or heavier clear plastic sheeting over finish surfaces. Tape to underside of shelves and frame, and remove protection after final Owner acceptance.

END OF SECTION

SECTION 12 36 62 – SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Acrylic-based fabricated solid surfacing countertops at locations as indicated in the drawings

B. Related Sections:
   1. Section 12 32 16 - Plastic Laminate-Clad Casework: Cabinets receiving solid surfacing countertops.
   2. Division 22 Sections: Plumbing fixtures and fittings.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM C97 – Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
   3. ANSI Z124.6 – Stain resistance of plastic fixtures.
   4. NEMA LD3 – High Temperature Resistance.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, integration of plumbing and electrical components, and anchorages.

C. Product Data: Submit data on specified component products.

D. Samples: Submit two samples, 12 x 12 inches in size illustrating each color, texture, and finish.

E. Manufacturer's Installation Instructions: Submit preparation of opening required, rough-in sizes, and tolerances for item placement.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required, and list of substances harmful to component materials. Include instructions for stain removal and surface and gloss restoration.

1.5 PERFORMANCE CHARACTERISTICS

A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 MAINTENANCE

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two containers of 16 oz of polishing cream for each material.

1.8 WARRANTY:

A. Provide manufacturer's limited commercial 10-year warranty against product defects.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' documented experience.

B. Installer: Fabricated and installed by manufacturer's certified fabricator/installer with a minimum of 5-years' experience in similar installations. Provide manufacturer's written certification with assurance of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SOLID SURFACING FABRICATIONS

A. Products:
1. Basis of Design: Corian as manufactured by DuPont, www.corian.com, or approved equivalent by *Staron Solid Surfaces* , www.staron.com
2. Color/Pattern Selection(s): As indicated in the Finish Schedule.
3. Substitutions: Section 016000 - Product Requirements.

B. Composition
1. Resin: Polyester type, with integral coloring and recycled metal shavings; stain resistant to domestic chemicals and cleaners.

2.2 SHOP FABRICATION

A. Finished Slab Thickness: As indicated in the drawings.

B. Slab Sizes: As indicated in the drawings.

C. Identification: Each slab shall be labeled with fabricator's batch number and imprinted with manufacturer's identifying mark on the back side.

D. Polish exposed surfaces to manufacturer's "Polished" finish with gloss rating of 35%.

E. Beveled or slightly radiused corners and edges.

F. Provide all necessary cut-outs. Obtain templates from plumbing subcontractor for fittings, sinks, and lavatories. Provide cut-outs with minimum 3/8" inside corner radius. Reinforce any remaining material less than 3-inches wide.

G. Laminate layers of materials as required to create built-up edges or other areas requiring additional thickness as indicated in the drawings.

2.3 ACCESSORIES

A. Mounting Adhesive: Silicone or two-component epoxy as determined by the installer for the particular installation.
1. Color: Adhesive that will be visible in finished work shall be tinted to match surfacing.
2. Provide spacers where required by the adhesive manufacturer for the particular installation.

3. Adhesives shall not contain urea formaldehyde.

B. Joint Sealants: Clear silicone sealant by Dow Corning or General Electric as recommended by the manufacturer for the specific application and conditions of use. Provide anti-mildew and anti-bacterial type.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. Store in racks in near-vertical position, indoors and away from direct exposure to sun or other heat source.

B. Protect against warpage and breakage.

C. Store with finished face turned toward finished face and separated by heavy paper or cardboard.

3.2 EXAMINATION

A. Reference Section 013000 - Administrative Requirements: Coordination and project conditions

B. Field-verify all relevant dimensions prior to beginning fabrication.

C. Verify that substrates supporting surfacing are plumb, level, and within plane to within 1/16-inch per ten-ft., and that necessary supports and blocking are in place.

D. Ensure that base cabinets are securely fixed to adjoining units and back wall.

E. Verify joint preparation and affected dimensions are acceptable.

3.3 INSTALLATION

A. Align work plumb and level.

B. Rigidly adhere or physically anchor finished panels in concealed manner to prevent movement or misalignment.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Indicated Dimension: 1/8 inch.

B. Maximum Offset from Indicated Position: 1/8 inch.

3.5 FINAL CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean and polish all exposed surfaces of quartz surfacing.

C. Furnish to the Owner (2) 16 oz. or larger containers of manufacturer’s recommended non-abrasive, low pH cleaning and polishing agent for each material.

END OF SECTION

Project Manual

February 21, 2025

STANTEC Project No. 21400 1184

FBISD BP031 Bush High School Renovations

Fort Bend Independent

School District

Sugar Land, Texas

100% Construction Documents

Volume 2 of 2

Rear Cover

SECTION 00 01 01 – PROJECT TITLE PAGE

TITLE AND LOCATION OF THE WORK:

FBISD BP031 – Bush High School Renovations

NAME AND ADDRESS OF THE OWNER:

Fort Bend Independent School District
16431 Lexington Blvd.
Sugar Land, TX 77479

ARCHITECT AND CONSULTANTS:

STANTEC ARCHITECTURE
ARCHITECT
910 Louisiana Street, Suite #2600
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S&G ENGINEERING CONSULTANTS
CIVIL ENGINEER
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832-437-7377

COMBS CONSULTING GROUP
LOW VOLTAGE CONSULTANT
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Boerne, Texas 78006
210-698-7887

MATRIX STRUCTURAL
STRUCTURAL ENGINEER
5177 Richmond Avenue, Suite 670
Houston, Texas 77056
713-333-0102

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
LIST OF DRAWINGS
CONTRACT DOCUMENTS

DOCUMENT 00 01 10 – MASTER TABLE OF CONTENTS

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Note: This Master Table of Contents includes **all** specification sections for the Project regardless of origin. Sections marked by asterisk (*****) below are provided by consultants to the Architect or Owner and are not covered by the Architect's seal.

Refer to attached supporting Tables of Contents to identify Consultant responsible for a particular section.

DIVISION 00 – OWNER PROCUREMENT AND CONTRACTING REQUIREMENTS
Bidding Requirements and Contract Forms for Competitive Sealed Proposals (CSP)

02.21.2025

DIVISION 01 - GENERAL REQUIREMENTS

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02.21.2025

DIVISIONS 29 & 30 - Not Used

DIVISION 31 – EARTHWORK: Reference Project Drawings for Civil Specifications

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

END OF VOLUME 2

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

02/21/2025

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MEP TABLE OF CONTENTS

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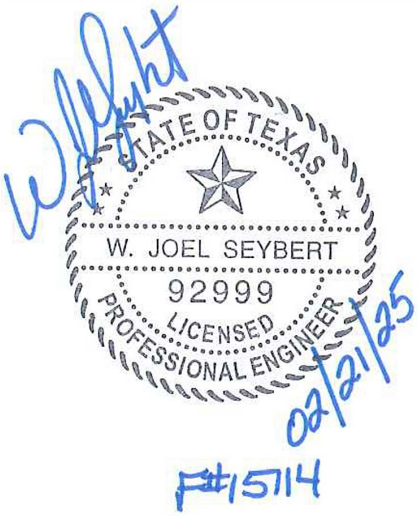

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DIVISION 02 – EXISTING CONDITIONS

DIVISION 31 – EARTHWORK

DIVISION 32– EXTERIOR IMPROVEMENTS

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DIVISION 32 - EXTERIOR IMPROVEMENTS

2-21-25

SECTION 21 00 00 - FIRE PROTECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, hose connections, and equipment covered by this Section, with all appurtenances, ready for owner's use.

1.3 RELATED WORK

A. Section 210201 - Coordination Drawings

B. Section 210529 - Hangers and Supports for Fire Suppression Piping and Equipment

C. Section 21 13 13 - WET PIPE SPRINKLER SYSTEM

D. Section 211316 - Dry Pipe Sprinkler Systems

E. Section 21 31 13 - Fire Pumps, Electric Drive

F. Section 221200 - Facility Potable-Water Storage Tanks

1.4 REFERENCES

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe

C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

D. FM Global Fire Protection Standards

E. NFPA 13 - Standard for the Installation of Sprinkler Systems

F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

G. UL - Underwriters Laboratories

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Domestic Manufacture: All valves, pipe, fittings, hose connections, and equipment shall be by a domestic manufacturer.

1.6 SUBMITTALS

A. Submit shop drawings in accordance with Section 22 02 00 and as described below.

B. Submit shop drawings of entire water-based building fire protection system with all standpipe, hose valve, and hose connection locations, including the accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

C. Submit complete product data for 21 31 13 - Fire Pumps, Electric Drive concurrently with the submittal for this Section, for all systems served by such equipment.

D. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

E. Submit product data to include pipe materials, pipe fittings, valves, hose connections, waterflow and alarm devices, and other appurtenances. Provide manufacturer's catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

1.7 REGULATORY REQUIREMENTS

A. Work in accordance with:
1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
4. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
5. Local codes that have jurisdiction.

B. Products in accordance with:
1. UL (Underwriters Laboratories) listed.
2. FM (Factory Mutual) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

A. Furnish Owner with test certificate certifying the system approved by:
1. Fire Marshal.
2. Insurance Services Officials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Work included:
1. Design, coordination, furnishing, and installation of inside and outside piping, valves, hose connections, drain and test risers, hangers, supports, and sleeves.
2. The standpipe system to be provided shall be an **automatic wet standpipe system** to serve all required stairways for the entire building unless specifically indicated otherwise.
    a. The Contract Drawings indicate the general extent and arrangement.
    b. The Contract Drawings identify water supply, pipe routing, control valves, and hose connections.
    c. The fire protection contractor shall make a final determination whether additional hose connections and associated piping are required and shall provide accordingly.

d. For sprinklered buildings, the system may be a combined system.

e. Permanently installed drain risers shall be provided at each standpipe equipped with pressure-regulating devices.

f. All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.

3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, hose connections, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
4. Coordinate work and installation with electrical and fire alarm contractors accordingly to interface system with the building fire and smoke alarm systems.

B. Requirements:
1. Materials and installation to meet or exceed the requirements of NFPA 13 and 14, (prevailing editions) and the local authority having jurisdiction (AHJ).
2. All components of the system shall be UL listed for the intended service.
3. Provide components with minimum pressure ratings as suited for system working pressure(s).
4. All hose connections shall be provided with approved threads, caps, and chains.

2.2 VALVES

A. General Requirements:
1. Valves shall be rated for no less than 175 psi.
2. All valves controlling connections to water supplies and to standpipes shall be listed indicating valves.
3. Drain and test valves shall be approved.
4. All control, drain, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.

B. Gate valves
1. Gate valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
3. Acceptable manufacturers:

a. Mueller Company

b. Kennedy Valve

c. Clow Valve Company

d. Nibco

C. Check valves
1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze or stainless fitted, non-slam type, suited for horizontal or vertical installation.
2. Acceptable manufacturers:

a. Mueller Company

b. Kennedy Valve

c. Clow Valve Company

d. Nibco

e. Tyco-Grinnell

D. Drain and trim valves shall be UL listed, bronze body and bonnet, with bronze stem and packing nut, and aluminum handwheel handle, by Nibco.

2.3 PIPE AND FITTINGS

A. All standpipe piping above grade shall be:
   1. ASTM A53/A53M schedule 40 black steel pipe with roll-grooved ends, joined with mechanical couplings and cut groove cast iron 300 psi rated fittings.

B. Acceptable manufacturers:
   1. Wheatland Tube Company
   2. Bull Moose Tube Company
   3. Tex-Tube
   4. Allied Tube

C. Acceptable mechanical coupling manufacturers:
   1. Victaulic
   2. Tyco-Grinnell
   3. Anvil-Gruvlok

2.4 FIRE HOSE VALVES, CONNECTIONS, AND EQUIPMENT

A. General requirements: All hose valves shall be listed. All hose connections shall be provided complete with connections, caps and chains conforming to local Fire Department requirements.

B. Acceptable Manufacturers:
   1. Potter-Roemer
   2. Dixon
   3. Elkhart Brass
   4. Croker

C. STANDPIPE HOSE VALVES: Female to male, straight or angle pattern as necessary to minimize intrusion into stair traffic area while ensuring clearance for connectivity and valve operation. Provide pressure regulating type (complete with visual indicator) as necessary, based on design and system pressure to ensure compliance with NFPA 14 maximum pressure requirements. 2-1/2” cast brass valve with red metal wheel handle and 1-1/2” reducer. Potter-Roemer Model 4065 or similar model with features as required and as described above.

D. ROOF MANIFOLD: Where there is no stairway access to the roof to provide a highest landing hose connection at this elevation, a hose connection shall be provided on the roof. Provide in accordance with NFPA 14 requirements for roof outlet piping, complete with hose valve, indicating control valve and ball drip connection to drain. Minimum two-way type cast brass body, Potter Roemer 5870 series with 2-1/2” hose valves.

E. FIRE DEPARTMENT CONNECTIONS: No less than 4” and two-way type, with additional connections and in larger size in accordance with system demand per NFPA. Polished chrome plated brass with lettering consistent with system type and service. Back, top, or bottom outlet as required for placement and wall construction for building mounted variations. Provide complete with accessibly located, listed check valve with approved automatic drip valve. Potter-Roemer Model 5751 (building mounted), Model 5761 (free-standing) or similar model with features as required and as described above.

PART 3 - EXECUTION

3.1 DESIGN

A. The Contractor shall conform to the requirements of NFPA 14 for standpipe and hose system design and installation. It shall be the Contractor's responsibility to determine if any deficiency or deviations exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

3.2 INSTALLATION

A. Install all items in accordance with applicable codes.

B. Piping shall be protected accordingly where subject to mechanical damage and/or fire damage.

C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D. Piping (mains and standpipes) shall be protected accordingly from freezing temperature with the use of supervised and listed heat tracing with insulation and jacketing.

E. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

F. Piping in finished spaces shall be routed concealed. This shall not include areas such as mechanical spaces, parking garages, and stairways. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G. All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.

H. Identify all locations requiring coordination with the electrical and fire alarm contractors accordingly to ensure connectivity with the building fire and smoke alarm systems. This shall include, but is not necessarily limited to, the following: water flow switches, alarm bells, and tamper/supervisory switches at control valves.

I. At building expansion joints provide approved system expansion joint fittings/assemblies accordingly and per manufacturer's recommendations and NFPA 13 requirements. Victaulic Style 155 carbon steel expansion joint for sizes up to and including 12" pipe.

3.3 PAINTING AND PIPE IDENTIFICATION

A. Painting of fire protection piping and appurtenances shall be provided as follows:
   1. Surfaces to be painted shall be cleaned as necessary to ensure they are free from dirt and oils.
   2. Unless directed otherwise by Architect, heat and water resistant, air-cured, high performance one-part epoxy paint shall be provided. Coating shall be high-gloss, lead-free, suited for indoor and outdoor use, and USDA approved. Armor-Poxy or similar.
   3. Fire sprinkler risers and associated alarm valves and related piping exposed in occupied spaces shall be painted red.
   4. Fire protection and sprinkler piping exposed in occupied spaces shall be painted as directed by Architect.
   5. Fire protection and sprinkler piping exposed in unoccupied accessory areas such as stairways shall be painted red unless directed otherwise by Architect.

B. Identification of fire protection piping shall be provided as follows:

1. All interior visible piping located in accessible spaces shall be provided with pipe markers and flow arrows. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
2. All exterior visible piping shall be provided with pipe markers and flow arrows.
3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
    a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
    b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.
    c. Markers shall indicate the pipe service, include flow directional arrows, and meet ANSI/ASME A13.1-2015.
5. Acceptable manufacturers:
    a. Seton Setmark Pipe Markers
    b. Brimar Industries Pipemarker System 1 Pipe Markers
    c. Brady Corporation
6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer’s installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
7. Markers shall be provided in accordance with ANSI/ASME A13.1-2015 requirements. **Specific items indicated below are not intended as a substitute for this complete standard**. Markers shall be provided:
    a. On both sides of each floor or wall penetration.
    b. On each side of each tee.
    c. On each side of each valve and/or valve group.
    d. On each side of each piece of equipment.
    e. On straight pipe runs at equally spaced intervals not to exceed 25 feet.
    f. In congested areas, on each pipe at the point it enters and exits the area.
    g. At the point of connection to each piece of equipment and automatic control valve.
    h. Where they are readily visible to personnel from the point of normal approach.
    i. With letter height and length of color field according to the size of the pipe served.
8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White

3.4 REPLACEMENT

A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.5 TESTING

A. Upon completion of the installation, test the system and obtain approval of the local fire insurance rating organization having jurisdiction.

3.6 TRAINING

A. Owner’s people shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented.

C. Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the final report.

END OF SECTION

SECTION 21 13 13 - WET PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

C. Refer to Section 21 00 00 for integral requirements.

1.2 SCOPE

A. Scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, sprinkler heads, and equipment covered by this Section, with all appurtenances, ready for owner's use.

B. The scope of work shall include the painting and pipe marking of fire sprinkler system piping as described in Section 21 00 00.

C. The scope of work shall include providing UL listed, FM approved factory-assembled automatic release air vents on sprinkler branch lines for the reduction of trapped air in the sprinkler system. Provide each complete with isolation valve, union or quick connect, wye strainer with valve, and drain line to drain in accordance with manufacturer’s recommendations and local requirements.

D. The provision of air vents shall be coordinated with any other systems or treatment for general corrosion or MIC (Microbiologically Influenced Corrosion) that may be specified.

1.3 RELATED WORK

A. Section 21 00 00 - FIRE PROTECTION

B. Section 21 02 01 - Coordination Drawings

C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D. Section 21 13 14 - Wet Pipe Sprinkler System, Corrosion Mitigation Program

E. Section 21 13 16 - Dry Pipe Sprinkler Systems

F. Section 21 13 17 - Dry Pipe Sprinkler System, Corrosion Mitigation Program

G. Section 21 31 13 - Fire Pumps, Electric Drive

1.4 REFERENCES

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

D. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

E. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

H. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

I. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2023.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and **country of origin**.

D. Domestic Manufacture: All valves, pipe, fittings, sprinkler heads, and equipment shall be by a domestic manufacturer.

E. Welding Procedures and Performance:
1. Meet or exceed the requirements of AWS B2.1/B2.1M “Welding and Brazing Qualifications”; as well as any local AHJ requirements.
2. Maintain and be able to produce complete certified records, including, but not necessarily limited to, the following: Welding Procedure Specifications (WPS’s), Procedure Qualification Records (PQR’s), and welder qualification records.

1.6 SUBMITTALS

A. Submit shop drawings in accordance with Section 22 02 00 and as described below.

B. Submit product data with manufacturer’s catalog information, product certifications, and **country of origin** identified. Indicate valve data and ratings. Product data to be submitted shall include, but not necessarily be limited to, the following:
1. Pipe material
2. Pipe fittings and couplings
3. Sprinkler heads and guards
4. Valves, air release vents, and backflow preventers
5. Waterflow, supervisory and alarm devices
6. Fire-stopping sealant and pipe marker products
7. Spare sprinkler head box, signage, and other accessories
8. Include a schedule of wall sleeves to be provided

C. Product data for hangers and and supports *may* be submitted under this section, although these items are specified under Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

D. Submit shop drawings of entire sprinkler system with all head locations and including accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

E. Submit complete product data for 21 30 00 - Fire Pumps **concurrently** with the submittal for this Section, for all systems served by such equipment.

F. Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, ducts, and a plan indicating fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.

G. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

H. Where a project is required to comply with FM Global requirements, ensure to submit a set of drawings, hydraulic calculations, and other required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.7 REGULATORY REQUIREMENTS

A. Work in accordance with:
1. NFPA 13
2. NFPA 14
3. NFPA 24
4. NFPA 25
5. Requirements of the local Authority Having Jurisdiction (AHJ).

B. Products in accordance with:
1. UL listed.
2. FM (Factory Mutual) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 INSPECTIONS AND CERTIFICATES OF TESTING

A. Furnish the Owner with test certificate certifying the system approved by:
1. Fire Marshal
2. Insurance Services Officials

B. Complete and submit a "Contractor's Material and Test Certificate for Underground Piping" in accordance with NFPA 13 Section 10.10 and ensure to receive Fire Marshal approval. This is required prior to full payment for underground work.

C. Complete and submit a "Contractor's Material and Test Certificate for Aboveground Piping" in accordance with NFPA 13 Section 25.10 and ensure to receive Fire Marshal approval. This is required prior to full payment for aboveground work.

D. All system acceptance testing shall be shall be witnessed by and signed off by the Fort Bend ISD MEP manager on the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. Work included:
1. Design, coordination, furnishing, and installation of inside and outside piping, valves, sprinkler heads, hangers, supports, and sleeves.
2. Reference Section 21 05 29 for additional sleeve requirements. Where sleeves are provided they shall extend 2" on either side of the wall or floor penetration. They shall be sized at no less than 1.5" diameter greater than the pipe enclosed.
3. The sprinkler system is an automatic wet pipe type system and shall be designed to provide coverage for the entire building unless specifically indicated otherwise.

a. The Contract Drawings indicate the general extent and arrangement.

b. The Contract Drawings identify rooms and spaces, which may aid in the determination of the various occupancy hazard classifications.

c. Sprinkler heads are not shown.

4. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, riser assembly/zone valves, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
5. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include, but not necessarily be limited to:

a. Flow and tamper switches - including any remote locations such as backflow preventer vaults, water supply post indicating valves, etc.

b. Waterflow signals ensure the immediate shut down of associated HVLS fans per NFPA 13, 11.1.7.

B. Requirements:
1. Materials and installation to meet or exceed the requirements of NFPA 13, prevailing edition and the local Authority Having Jurisdiction (AHJ).
2. All components of the system shall be UL listed for the intended service.
3. Provide components with minimum pressure ratings as suited for system working pressure(s).

2.2 VALVES

A. General requirements:
1. Valves shall be rated for no less than 175 psi.
2. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves.
3. Drain and test valves shall be approved.
4. All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.
6. A listed relief valve not less than 1/2" in size shall be provided on each wet pipe system, in accordance with NFPA 13 requirements. Provide a piped drain line to the outdoors for each such valve.

B. Alarm Valves
1. Riser alarm valves shall be UL listed, FM approved alarm check valve type complete with pressure actuated switch or riser check valve type with a listed vane type waterflow alarm switch.

a. Approved pressure gauges shall be provided on both the supply and system sides of the valve.

b. Valve body shall include a removable cover for check clapper access.

2. Local waterflow alarm devices shall be a listed water-motor operated device or an electrified bell type for outdoor installation. Additionally, provide an electrified bell for indoor installation. System Sensor, Potter, or Reliable.
3. Provide connectivity to the building fire alarm system.
4. Acceptable valve manufacturers:

a. Reliable

b. Viking
c. Tyco-Grinnell
d. Victaulic (acceptable for alarm check valve variations only)

C. Control Valves (Gate)
1. Control valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
3. Acceptable manufacturers:
a. Mueller Company
b. Kennedy Valve
c. Victaulic
d. Nibco

D. Control Valves (Butterfly)
1. Control valves shall be UL listed, FM approved ductile iron bodied, gear operated with flag, butterfly type.
2. Acceptable manufacturers:
a. Reliable
b. Kennedy Valve
c. Tyco-Grinnell
d. Victaulic
e. Nibco

E. Check Valves
1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze fitted, non-slam type, suited for horizontal or vertical installation.
2. Acceptable manufacturers:
a. Mueller Company
b. Kennedy Valve
c. Victaulic
d. Nibco
e. Tyco-Grinnell

F. Test and Drain Valve Assemblies shall be UL listed, FM approved bronze bodied ball valve type complete with tamper resistant test orifice and sight glasses. AGF Manufacturing, Inc.

G. Automatic air release valve and vent assemblies shall be UL listed, FM approved and provided complete with brass or bronze bodied ball valves, stainless steel mesh strainers, and float operated air release valves. Acceptable manufacturers:
1. Engineered Corrosion Solutions PAV-W.
2. Tyco TAV-W.
3. Potter PAAR-B.

H. Backflow Preventers: Provide as indicated on the Drawings and in accordance with the requirements of the water supplier and public health authority having jurisdiction. All such devices shall be listed for fire protection service.

2.3 PIPE AND FITTINGS

A. Underground service entry shall be: UL listed, FM approved, NFPA 24 compliant, type 304 stainless steel, pre-fabricated in-building riser. Acceptable manufacturers:
   1. Ames Fire & Waterworks
   2. Zurn Wilkins

B. All sprinkler system piping above grade shall be (refer to 21 00 00 for **standpipe** system piping):
   1. ASTM A135/A135M / ASTM A53/A53M schedule 10 black steel pipe with roll-grooved ends, joined with mechanical couplings and with manufactured carbon steel grooved fittings with matching mechanical couplings for pipe 1” and larger. Fittings shall be fully metallically formed type with an independent gasket and coupling at each pipe connection. All coupling assembly points shall have bolts and nuts.
   2. ASTM A135/A135M / ASTM A795/A795M schedule 40 black steel threaded pipe and cast iron or malleable iron fittings for sizes under 1".
   3. Welding shall be acceptable only for providing ASTM A53/A53M shop welded, branch outlet fittings, UL Listed and FM Approved for use in fire sprinkler systems, in accordance with NFPA 13 and local AHJ requirements.
      a. Merit Manufacturing Corporation or pre-approved equal.
      b. In no case shall butt-welding of pipe ends be allowed.

C. Acceptable manufacturers:
   1. Wheatland Tube Company
   2. Bull Moose Tube Company
   3. Tex-Tube
   4. Allied Tube

D. Acceptable mechanical coupling manufacturers:
   1. Victaulic
   2. Tyco-Grinnell
   3. Anvil Gruvlok

E. **Regardless of manufacturer, the use of pipe hole-cut, gasketed bolt-on branch outlets shall not be permitted. This prohibition includes, but is not necessarily limited to, the following: clamp-T, mechanical-T, outlet-T, strap-T, and U-bolt-T outlet connectors.**

F. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

2.4 SPRINKLER HEADS

A. Suspended Ceiling Type: Standard concealed pendent type with white cover plate.

B. Exposed Area Type: Standard upright type with brass finish.

C. Sidewall Type: Chrome plated finish with matching escutcheon.

D. Where maximum ceiling temperatures exceed 100 degrees F, sprinklers with temperature ratings in accordance with maximum ceiling temperatures as tabulated in NFPA 13 shall be provided. Sprinkler heads within a given compartment must all be of the same temperature rating. Ambient ceiling temperatures expected in the vicinity of the sprinklers must be considered accordingly. Possible high ambient temperature areas may include, but are not necessarily limited to, the following: electrical equipment rooms, kiln rooms, sauna rooms, and manufacturing/process spaces.

E. Sprinkler heads of the “O”-ring seal type are not acceptable.

F. In all locations subject to corrosive conditions provide heads entirely constructed of stainless steel or heads with polyester coated finish and dipped in wax. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens.

G. In all locations subject to occupant abuse or vandalism provide institutional type sprinkler heads with tamper-resistant construction and suitable “break-away” weight test documentation from the manufacturer. Such locations shall include, but not necessarily be limited to, the following: patient areas of institutional mental health occupancies, prisoner areas (cells, etc.) of correctional facilities – jails, prisons, juvenile detention facilities.

H. Flexible type sprinkler head connections are acceptable for locations with suitable finished ceilings, provided they are:
   1. Domestically manufactured, UL listed and FM approved.
   2. Acceptable to the local Authority Having Jurisdiction.
   3. Commercial grade, with a 300 series stainless steel braided hose and collar design.
   4. Provided with brackets by the same manufacturer as the head connections.
   5. Connected only to steel sprinkler piping.
   6. Manufactured by Victaulic, Easyflex, or ASC Engineered Solutions.

I. Acceptable manufacturers:
   1. Tyco-Grinnell
   2. Viking
   3. Victaulic
   4. Reliable
   5. Globe Fire Sprinkler Corporation

2.5 FIRE DEPARTMENT CONNECTIONS

A. Refer to Section 21 00 00 for all such requirements.

2.6 INSULATION

A. All piping and valves exposed to the weather or within building and exposed to the weather shall be insulated with phenolic foam with ASJ and all joints sealed. Insulation density shall not be less than 1.5 pounds per cubic foot, and conductivity (K) not higher than 0.25 and 75 degrees F mean temperature difference, with factory applied all weather vapor barrier jacket.

B. All piping and valves in the central plant/main mechanical room and the main electrical room shall be insulated with 2" thick fiberglass insulation with ASJ and all joints sealed. All such insulated piping shall be identified per Section 21 00 00 requirements for "interior visible piping."

C. All insulated pipe and valves subject to damage shall be protected with an aluminum jacket with sealed joints.

D. Refer to Section 22 07 19 for detailed specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA 13 and installed as per manufacturer's recommendations.

C. For any area requiring sprinkler protection and where the piping will be subject to freezing, the expectation is that a wet pipe system complete with a listed heat tracing system complete with insulation and electric supervision will be provided. This shall apply whether or not such an area has been identified on the Drawings and whether or not such a system has been specified under a separate Section. Dry pipe sprinkler systems shall not be acceptable.

3.2 DESIGN

A. Design spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the occupancy hazard.

B. Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C. Friction losses in pipe will be based on a value of "C" =120 in the Hazen - Williams formula for steel pipe and "C" =150 for listed CPVC pipe (only if specified).

D. Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork, structural members, or lighting fixtures.

E. The Contractor shall conform to NFPA 13, prevailing edition. Special attention shall be given to the Chapters on Plans and Calculations and on Systems Acceptance. It shall be the Licensed Fire Sprinkler Contractor's responsibility to determine if any deficiencies exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

F. Design sprinkler system piping accordingly and provide hose connections complete with valves, hoses, and cabinets where and as required by code. Adhere to the acceptable manufacturers listed in Section 21 00 00. Locations shall include, but are not necessarily limited to, the following: theatrical stages greater than 1,000 square feet.

G. Reference the latest architectural reflected ceiling plans. Extend branch lines accordingly to provide sprinklers both above and below "cloud" ceilings, where present and as required.

H. Ensure to provide sprinklers under fixed obstructions (such as ductwork) over 48 inches wide.

3.3 INSTALLATION - GENERAL

A. Install all items in accordance with applicable codes.

B. Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.

C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D. Furnish additional heads which may be required for coordinated ceiling patterns without added cost, even though number of heads may exceed minimum code requirements.

E. All sprinkler heads shall be located as near the center of ceiling tiles as is practical (±1/2”). Location shall present a uniform pattern with all heads aligned when completely installed. Do not locate sprinkler heads within 6 inches of light fixtures, air devices, or other similar items.

F. Run piping concealed above furred ceilings and in joist space to minimize obstructions. Piping shall not penetrate ductwork or light fixtures. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G. In areas without ceilings, sprinkler piping shall be routed as tight as possible to building elements at no less than 8'-0" AFF.

H. Provide wire guards on all non-concealed pendent and upright sprinklers heads subject to damage, including, but not necessarily limited to, the following locations: mechanical rooms, gymnasiums, athletic areas, wood and metal shops.

I. Locate outside alarms on wall of building adjacent to sprinkler riser room.

J. Provide on wall near the sprinkler valve(s): a clearly labeled and suitably sized cabinet containing (a minimum of 5% but no less than four) spare sprinkler heads and also wrenches for each type head type.

K. Provide a minimum of 5% but no less than one case of spare escutcheons for each type of sprinkler head.

L. Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.

M. Where access panels are necessary to provide system valves and gauges, they shall be minimum 24"x24" or larger as needed to ensure proper access.

3.4 INSTALLATION - DRAINAGE

A. All sprinkler pipe and fittings shall be installed so that the system can be drained.

B. Unless not practicable, all piping shall be arranged to drain to the main drain valve for each sprinkler system. Make provisions accordingly for any trapped piping and provide auxiliary drains as necessary, complete with signage, and in accordance with NFPA 13 requirements.

C. All system drain locations shall be located in building mechanical rooms and propoerly labeled per NFPA requirements. All such locations shall be noted on the as-built drawings.

D. Unless noted otherwise on the Drawings or in conflict with Owner requirements, all drains shall discharge to the outdoors at locations free from the possibility of causing water damage. Each such drain shall be provided with a chrome wall escutcheon and 45 degree galvanized ell turned down.

3.5 INSTALLATION - AIR VENTS

A. Each system shall be provided with at least one (1) automatic air vent, however more than one (1) may be required on a given system in order to exhaust the trapped air.

B. Each air vent shall be located near a high point in the system it serves. Provide each such vent where it will be most effective and locate it off the top of the horizontal piping in an accessible location and a level position.

3.6 SYSTEM IDENTIFICATION

A. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction sheet shall be laminated or protected by a transparent plastic cover.

B. Provide full size zone map(s) at the main fire alarm control panel clearly indicating the geographical area protected by each zone valve/floor control assembly. Each floor plan shall include the building physical address, locations of FDCs, control valves, drain and test valves (all marked and labeled) and reflect actual room numbers as indicated in the final approved architectural room graphics package. All sprinkler head locations shall also be shown. Provide in 30"x42" format in framed layout with plexiglass front.

C. Provide additional map(s) as described above at the riser location(s).

D. All hydraulic calculation plates must be engraved.

E. Each system valve (indoor and outdoor) must be permanently labeled with the system information.

F. Signage:
   1. Each riser room door must have a 2'-0" x 3'-0" sign provided on the outside with the wording "SPRINKLER RISER ROOM."
   2. Each fire department connection shall have a sign with the street address on it.
   3. Signage provided shall comply with NFPA and local AHJ requirements.

3.7 PAINTING AND PIPE IDENTIFICATION

A. Refer to Section 21 00 00 for all such requirements.

3.8 REPLACEMENT

A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.9 TESTING

A. Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.

B. Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the acceptance requirements of NFPA 13.

C. Testing and acceptance must be provided for underground and aboveground piping per NFPA 13 and local AHJ requirements. Documentation of such shall be provided to the Owner.

3.10 TRAINING

A. The Owner's maintenance staff shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B. Routine maintenance, yearly maintenance, and any seasonal requirements or considerations shall be fully discussed and documented.

C. Names of those instructed and dates, as well as a list of information provided to the Owner shall be included in the final report.

END OF SECTION

SECTION 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to locations of piping, appurtenances, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B. The piping, fixture, and equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be provided by the Contractor at no additional cost to the owner.

D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified elsewhere. Prime and protective painting is included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such times as the project is ready to receive the fixtures, equipment, pipe, valves, etc. - properly protected from incidental damage and weather damage.

C. Damaged fixtures, equipment, valves, pipe, or appurtenances shall be promptly removed from the site and new, undamaged items shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise, water hammering, and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

E. Above ceiling piping and valves shall not be installed in direct contact with the work of other trades, including, but not limited to, suspended ceiling hanger wire.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards.

D. Such codes and standards shall include, but not necessarily be limited to:
   1. American Standards Association, ASA.
   2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
   3. American Society of Mechanical Engineers, ASME.
   4. American Society of Plumbing Engineers, ASPE.
   5. American Society of Testing Materials, ASTM.
   6. American Water Works Association, AWWA.
   7. National Bureau of Standards, NBS.
   8. National Fire Protection Association, NFPA.
   9. UL, LLC (formerly Underwriters Laboratories).
   10. FM Global.
   11. International Energy Conservation Code, IECC.
   12. International Fire Code.
   13. International Fuel Gas Code.
   14. International Plumbing Code.

E. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

F. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to address any part of the work which the Drawings can fully convey in every particular and such omission shall not to relieve the Contractor from carrying out portions of work indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification indicates that products of similar design and equal construction from the list of acceptable manufacturers may be used, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outlined herein.

I. Where equipment other than that used in the design as specified or shown on the Drawings is provided (either from an acceptable manufacturer list or by submittal review), it shall be the responsibility of the Contractor to coordinate space requirements, building provisions and connection requirements with all trades bear any additional costs.

J. Where permission to use a substitution product, material, or method is granted by the Owner or Engineer in writing, the Contractor shall bear full responsibility for the implementation of that substitution. Specific responsibilities shall include, but shall not be limited to, the following:

1. Verifying that the substituted item will fit in the space available. This shall include allowances for all code required clearances and manufacturer's maintenance and service clearances.
2. The coordination and provision of all necessary supports, hangers, and appurtenances. Hanger spacing shall be adjusted accordingly and any additional hangers or supports required shall be provided.
3. The coordination and provision of all necessary insulation, firestopping provisions, etc.
4. Adherence to manufacturer's published installation recommendations.
5. Adherence to requirements of the Authority Having Jurisdiction (AHJ) and provision of a code compliant installation.
6. Changes to architectural, structural, electrical, mechanical, and plumbing requirements as a result of the substitution.
7. Bearing any additional costs and time impact and providing any necessary redesign. The Owner will bear no such cost and make no time allowances.
8. Coordination of plumbing and electrical requirements and utility provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR’S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor’s stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not necessarily limited to, the following items:
1. Basic Materials.
2. Plumbing Fixtures and Valves.
3. Supports and Carriers.
4. Floor Drains, Roof Drains, and Cleanouts.
5. Interceptors/Traps (All Types).
6. Water Heaters and Boilers.
7. Expansion Tanks.
8. Water Softeners.
9. Water Treatment Equipment.
10. Water Filters.
11. Domestic Water Booster Pumps.
12. Fire Pumps and Jockey Pumps.
13. Storm, Sanitary, and Wastewater Pumps and Ejectors.
14. Fire Pump and Jockey Pump Controllers.
15. Domestic Water and Fire Protection Break Tanks.
16. Backflow Preventers.
17. Plumbing Piping.
18. Piping, Vessel, and Equipment Insulation.
19. Air Compressors and Air Dryers.
20. Expansion Fittings and Devices.
21. Variable Frequency Drives.
22. Noise and Vibration Controls.
23. Pipe and Equipment Hangers and Supports.
24. Plumbing Specialties.
25. Test, Adjust and Balance Reports.
26. Testing, Adjusting and Balancing Contractor Qualifications.
27. Coordination Drawings.

I. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
      a. Wall locations and types.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm, sanitary sewer piping and plumbing piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:
   1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
   2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
   4. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

   CERTIFIED RECORD DRAWINGS
   DATE:
   (NAME OF GENERAL CONTRACTOR)
   BY: _____
   (SIGNATURE)
   (NAME OF GENERAL CONTRACTOR)
   BY: _____
   (SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include operational, trouble-shooting, and routine maintenance information for fixtures, specialties, and equipment.
   1. Identifying names, name tags designations and locations for all equipment.
   2. Valve tag lists with valve number, type, color coding, location and function.
   3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
   4. Fabrication drawings.
   5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
   6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   8. Servicing instructions and lubrication charts and schedules.
   9. Equipment and motor name plate data.
   10. Wiring diagrams.
   11. Exploded parts views and parts lists for all equipment and devices.
   12. Color coding charts for all painted equipment and conduit.
   13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
   14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow 1/4” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel.

B. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

C. Before proceeding with the instruction of Owner’s Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

D. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable only for minor superficial scratches, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.

E. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.
   1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
   2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
   3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D. Access doors shall be as follows:
   1. Plastic Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 SUPERVISION

A. Per district requirements, all plumbing work shall be supervised at all times by an individual currently licensed as no less than a Journeyman plumber.

3.2 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.3 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
   4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces.
    a. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
    b. For toilet rooms with hard ceilings where the chase is not accessible, provide no less than a 24"x24" access panel effectively positioned adjacent to the "wet" wall for maintenance and inspection purposes. For back to back toilet room installations, such panels shall be located in boys/mens rooms wherever possible.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.
19. All necessary precautions shall be taken when welding or cutting or installing pipe to prevent damage to roofs. Any damage shall be repaired by the approved roofing contractor, with payment made by the responsible party. The extent and nature of any repairs necessary shall be as approved by the Fort Bend ISD Design Manager.

3.4 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, removal, patching, replacement/repair as required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.
5. Install fixtures, equipment, piping, and appurtenances in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch and replace/repair existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.5 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.6 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. Existing piping and related appurtenances which will no longer serve fixtures or equipment (due to their removal) and which is not intended for re-use shall be removed and disposed of off-site. Where such piping cannot be removed and must be abandoned in place, it shall be labeled, purged, and capped at both ends. Such piping shall also be noted on As-Built Drawings.

E. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

F. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

G. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

H. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

I. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

J. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

K. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

L. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

M. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

N. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

O. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

P. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

SECTION 22 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
    a. Wall and type locations.
    b. Clearances for installing and maintaining insulation.
    c. Locations of light fixtures and sprinkler heads.
    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    e. Equipment connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Routing of storm and sanitary sewer piping.
    h. Fire-rated wall and floor penetrations.
    i. Sizes and location of required concrete pads and bases.
    j. Valve stem movement.
    k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.

H. Sequence of Coordination

Below is hierarchy of model elements and the sequencing by which the models will be coordinated.

1. Structural and Architectural model
2. Miscellaneous steel
3. Perform preliminary space allocation
4. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
5. Main and medium pressure ducts from the shaft out
6. Main graded plumbing lines and vents
7. Sprinkler mains and branches
8. Cold and hot water mains and branches
9. Lighting fixtures and plumbing fixtures
10. Smaller sized ducts and flex ducts
11. Smaller size cold water and hot water piping, flex ducts, etc.

I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J. The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 22 03 00 - PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition of plumbing systems and components.

B. The drawings do not show all demolition work required. The contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.2 RELATED SECTIONS

A. Alteration Project Procedures (may be present under Division 01).

B. Selective Demolition (may be present under Division 02).

1.3 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will corporate with the Contractor, however, the following provisions must be observed:
   1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.
   2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

1.4 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, systems, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by his contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe, fittings, and hangers and/or line supports. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases of construction may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Project Administrator at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the owner's property. Repair, patch or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Corporate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

J. All existing plumbing fixtures, pipe, materials, equipment, and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural "Demolition and/or Alteration" plans for actual location of walls, ceiling, etc., being removed and/or remodeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements and piping arrangements are as shown on Drawings.

B. Verify that abandoned piping and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.

D. Existing Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

A. Demolish and extend existing plumbing work under related provisions of Division 1, Division 2, and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping to source of supply.

D. Remove exposed abandoned piping systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing installations which remain active. Modify installation or provide access panels as appropriate.

G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Alteration Project Procedures Section.

3.6 REMOVAL OF MATERIALS

A. The contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

E. Certain work during the demolition phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner's Representative at least 72 hours in advance.

F. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.

G. Include in the contract price all rerouting of existing conduits, wiring, outlet boxes, fixtures, etc., and the reconnecting of existing fixtures as necessitated by field conditions to allow the installation of the new systems. Furnish all temporary conduit, wiring, boxes, etc., as required to maintain lighting and power service for the existing areas with a minimum of interruption. Remove wire and conduit back to nearest accessible active junction box and extend to existing homeruns as required.

H. The contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

I. Where existing construction is removed to provide working and extension access to existing utilities, contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

J. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

END OF SECTION

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fittings and items covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
   1. Expansion joints and compensators.
   2. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

A. Section 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING

B. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

C. Section 22 10 00 - PLUMBING PIPING

1.4 REFERENCES

A. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.5 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:
   1. Installation Temperature: 50 degrees F (10 degrees C).
   2. Domestic Hot Water: 140 degrees F (60 degrees C).
   3. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.6 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:
   1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

2. Pipe loops, offsets, and swing joints: Indicate temperature rise, developed lengths, pipe size, material expansion coefficient-allowable stress-modulus of elasticity, and final calculated amount of expansion. Indicate bend, loop, offset & return dimensions coinciding with the calculated expansion.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of expansion joints, fittings, anchors, and guides.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, project and handle products to site under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):
1. Manufacturers:
a. VMC Group, Style EB
b. Triplex, Model Resistoflex R6905
c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)

d. Metraflex
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

B. Pre-manufactured Loop Type:
1. Manufacturers:
a. Flexicraft Industries
b. Metraflex MLS-UPC-80 series
2. Materials of construction: Copper custom 180 degrees bend (or 90 degree elbows with spool), copper 90 degree elbows for connections to piping, bronze hose and braid.
3. Certifications: NSF 61 lead-free compliant, IAPMO (UPC) approved.
4. Working Pressure: No less than 200 psi at 250 degrees F.
5. Allowable Movement: +/- 4 inches.
6. Labeled from the manufacturer and provided complete with attached support bracket and drain plug.
7. Size: Same as piping being served.
8. Installation: In strict accordance with manufacturer's recommendations, including support.
9. Application: Copper piping 4 inch and under.

2.2 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:
1. Manufacturers:
a. Triplex, Model Flexonics
b. Metraflex
2. Welded steel construction bolt together two piece design, frame with four mounting holes, shop painted, spider type guide, exact style/model as necessary for bare or insulated pipe to match size and thickness as appropriate, 4 inch movement standard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. This shall include where piping crosses expansion joints in the building.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by manufacturer's representative for final installing and to certify the installation is in accordance with manufacturer's recommendations and expansion joints and accessories are performing satisfactorily.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe, and equipment hangers, supports, and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

A. Section 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING

B. Section 22 07 19 - PLUMBING PIPING INSULATION

C. Section 22 10 00 - PLUMBING PIPING

D. Section 22 11 21 - NATURAL GAS PIPING SYSTEMS

1.4 REFERENCES

A. ASME B31.1 - Power Piping; 2024.

B. ASME B31.9 - Building Services Piping; 2020.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.5 QUALITY ASSURANCE

A. Hangers and Supports for Plumbing Piping: In conformance with ASME B31.1 and ASME B31.9.

B. Hangers and Supports for Plumbing Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Free-standing manufactured pipe support system with hot dip galvanized steel components and hardware with UV-inhibited injection molded high density/high impact black polypropylene base material. Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2” and smaller	Type PP10-R, with pipe roller support
For pipes 3” through 8”	Type PS-1-2, with pipe roller support
For multiple pipes	Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. For installation of protective shields also reference Section 22 07 19.

M. Shields for Vertical Copper Pipe Risers: Sheet lead.

N. Pipe Rough-In Supports in Walls/Chases: Provide pre-formed plastic pipe supports, Sioux Chief “Pipe Titan”, Hold Rite or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing.

C. Caps: Steel, 20 gauge minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

2.6 ROOFTOP PIPE SUPPORTS

A. All roof-mounted piping shall be supported with engineered pre-fabricated piping support systems specifically designed to be installed on the roof without roof penetrations, flashing, or damage to the roofing material.
   1. Bases shall be made of UV protected HDPE.
   2. Frames shall be made of hot dipped galvanized strucutral steel.
   3. Nuts, threads, and washers shall be hot dipped galvanized steel.
   4. System shall be specifically designed to fit the piping and the actual conditions of service.
   5. Wood supports are not acceptable.
   6. Portable Pipe Hanger (PHP) system or pre-approved equal, installed per manufacturer's instructions.

2.7 SLEEVES

A. All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.

B. Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:
   1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
   2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.
   3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.

C. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

D. Caulk: Paintable 25-year acrylic sealant.

E. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.8 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.9 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX/ HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B. Sagging of horizontal pipe is unacceptable.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers. Also reference specific requirements for cast iron piping installation in Section 22 10 00, Part 3 Execution.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners and hardware, braces, unistrut, structural steel members, etc. to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

I. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J. Support riser piping independently of connected horizontal piping.

K. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

3.3 INSULATED PIPING

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8” thick coat of mastic.

C. Shields: Install protective shields MSS Type 40 on insulated piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8” thick coat of mastic.

D. Galvanized sheet metal shields shall span an arc of 180 degrees and shall have dimensions not less than the following:

Nominal Pipe Size	Shield Length	Gauge Thickness
1/4 through 3-1/2 inch	12 inch	18
4 inch	12 inch	16
5 through 6 inch	18 inch	16
8 through 14 inch	24 inch	14
16 through 24 inch	24 inch	12

E. Ensure to provide an insert of high density insulation (calcium silicate) at each hanger/support to prevent the weight of the pipe from otherwise crushing the insulation. This insert material shall be at least as long as the associated protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the items covered by this Section, with all appurtenances, ready for owner's use.

B. All plumbing piping shall be appropriately labeled.

C. Refer to Architectural Sections for any additional requirements.

1.3 RELATED WORK

A. Section 22 10 00 - PLUMBING PIPING

B. Section 22 07 19 - PLUMBING PIPING INSULATION

1.4 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:
   1. All valves shall be identified with a 1-1/2" diameter brass valve tag with stamped, black or red filled characters. Service designations shall be 1/4" letters and valve numbers shall be 1/2" numbers. Secure tags to valve handles by use of use of copper or Monel wire seals. For any services not identified below, contact Engineer in advance for approval. Service designations:
      a. Domestic cold water: DCW
      b. Domestic hot water: DHW
      c. Domestic hot water return: DHWR
      d. Natural gas: GAS
      e. Compressed air: AIR
   2. All valves on the project shall be numbered sequentially, with valves for any one system and/or trade grouped together.
   3. Valve tags are not required if the valve is located within 3'-0" of the equipment being served and the service is obvious.

4. Catalog a complete written record of all valves on the project, whether tagged or not. Include manufacturer, model number, size, service, system pressure (if like services with differing pressures are present on the project), location, valve tag data, and a description of the equipment/room/area served. Any valves which must be operated in sequence shall be indicated as such. Prepare a valve chart/schedule with all such information and include this chart/schedule in the project Operating and Maintenance Manual.
5. Mark all valve locations on the record drawings with appropriate identifying symbols or information to align with the above referenced valve chart/schedule. In addition to the O&M submission, provide the Owner with a digital copy (PDF format) of all such information in high-resolution, suitable for printing as full size drawings.
6. Tags and fastenings shall be manufactured by the Seton Nameplate Corporation or approved equal.
7. In addition to tags, all isolation valves serving emergency safety fixtures shall be provided with immediately adjacent clear and permanent signage indicating their purpose so as to avoid accidental shut-off.

B. Pipe Marking:
1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
2. All exterior visible piping shall be provided with pipe markers.
3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
    a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
    b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.
    c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.
5. Acceptable manufacturers:
    a. Seton Setmark Pipe Markers
    b. Brimar Industries Pipemarker System 1 Pipe Markers
    c. Brady Corporation
6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer’s installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
7. Markers shall be provided in accordance with ASME A13.1 requirements. Specific items indicated below are not intended as a substitute for this complete standard. Markers shall be provided:
    a. On both sides of each floor or wall penetration.
    b. On each side of each tee.
    c. On each side of each valve and/or valve group.
    d. On each side of each piece of equipment.
    e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
    f. In congested areas, on each pipe at the point it enters and exits the area.
    g. At the point of connection to each piece of equipment and automatic control valve.

h. Where they are readily visible to personnel from the point of normal approach.

i. With letter height and length of color field according to the size of the pipe served.

j. For non-potable water not less than once per room and at equally spaced intervals not to exceed 20 feet.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Sanitary Sewer	Green	Sanitary Sewer	White
	Green	Plumbing Vent	White
Storm Drain	Green	Storm Drain	White
	Green	Overflow	White
Domestic Water	Green	Domestic Cold Water	White
Domestic Hot Water	Green	Domestic Hot Water	White
Domestic Hot Water Return	Green	Domestic Hot Water Return	White
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White
Fuel Gas	Yellow	Natural Gas	Black
	Yellow	Propane Gas	Black
Diesel	Yellow	Diesel Oil	Black
Compressed Air	Blue	Compressed Air	White
Nitrogen	Orange	Nitrogen	Black
Carbon Dioxide	Orange	Carbon Dioxide	Black
Non-Potable Water	Yellow	Caution: Non-Potable Water, Do Not Drink	Black
Deionized Water	Green	Deionized Water	White
Reverse Osmosis Water	Green	R.O. Water	White
Acid Waste	Orange	Acid Waste	Black
		Acid Vent	Black

C. Pipe Painting:

1. Pipe painting shall be per the color schedule below or as directed by the Architect. Confirm all color selections with Architect prior to installation, in particular for exposed piping in publicly occupiable areas.
2. All exterior piping shall be painted.
3. All piping subject to corrosive conditions shall be painted. This shall include, but not necessarily be limited to: natatoriums, pool equipment rooms, chemical and metal processing areas, and animal pens.
4. All exposed piping shall be painted (including, but not limited to: piping in mechanical rooms, kitchens, and storage rooms).
5. Paint color schedule:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange

Fuel Gas (except for utility provider installed piping)	Yellow, unless specifically indicated/required otherwise by Architect or AHJ

2.2 EQUIPMENT IDENTIFICATION

A. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

2.3 ABOVE CEILING IDENTIFICATION

A. At all above ceiling isolation valves, provide a permanent label on the ceiling grid. Label shall be a pre-manufactured heavy duty adhesive backed vinyl label, white background with black letters, indicating "SOV". Seton or equivalent.

B. Provide a laminated sheet (one page for each floor) in the main custodial office showing all valve locations and related valve number.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. All labeling equipment shall be installed per manufacturer’s printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items as required per manufacturers' requirements.

C. All piping to be painted shall be cleaned of rust, dirt, grease, oil and all other contaminants prior to painting. Provide primer if and as recommended by the paint manufacturer. Provide a quality polyamine epoxy paint over all surfaces of pipe.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:
   1. Interior domestic hot water and hot water return piping.
   2. Interior domestic cold water piping located in exterior walls and to a point no less than 8'-0" inside the building. Also insulate entire roof hydant box in exterior walls.
   3. Main domestic water entry pipe and any associated branch lines for 50 linear feet within the building.
   4. Exterior domestic cold water piping.
   5. Drain bodies and associated piping. Also insulate entire associated roof drain hangers, up to the threaded rod.
   6. Condensate drainage piping.
   7. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.
   1. Painting.
   2. Pipe hangers and supports.

D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

C. Section 22 10 00 - PLUMBING PIPING

1.4 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

D. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

E. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

H. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E. All piping insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

B. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Flexible closed-cell elastomeric thermal insulation by Armacell.

D. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

E. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.3 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: Provide pre-formed glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

B. EXTERIOR DOMESTIC WATER PIPE: Provide preformed phenolic foam in accordance with ASTM C1126 with secured aluminum jacketing.

C. ROOF DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies with segmented fiberglass board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. For associated horizontal piping, including first turn down to vertical conductor, provide glass mineral wool insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

D. CONDENSATE AND SIMILAR DRAINAGE:
   1. Condensate piping: Provide flexible closed cell elastomeric thermal insulation in tubular form in accordance with ASTM C534/C534M, model "Armaflex Ultima", fire rated for use in environmental air plenums. Insulation is not required where piping is exposed on a roof.
   2. Waste lines from water coolers and refrigerated drinking fountains to junction with main waste stacks: Insulate as described above.
   3. Underside of floor drains and similar receptors receiving cooling coil condensate and the tailpieces, p-traps, and the associated piping to junction with main waste stacks: Insulate as described above.

E. ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

F. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed, complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. Pipes located outdoors, in tunnels or crawlspaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

D. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

E. Provide all piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.
   1. Low temperature surfaces - Minimum Insulation Thickness
      a. Exposed exterior domestic water pipe: 1-1/2 inch
      b. Interior domestic cold water pipe: 1 inch
      c. Condensate drain lines: 3/4 inch
      d. Drains receiving condensate: 1 inch
      e. Concealed piping from roof drains: 1-1/2 inch
      f. Exposed piping from roof drains: 1 inch
   2. Domestic Hot Water and Return Piping - Minimum Insulation Thickness
      a. Pipe sizes 1-1/4 inch and smaller with operating temperatures of 140°F or less: 1 inch
      b. Pipe sizes 1-1/2 inch and larger with operating temperatures of 140°F or less: 1-1/2 inch

c. Pipe sizes 1-1/4 inch and smaller with operating temperatures greater than 140°F: 1-1/2 inch

d. Pipe sizes 1-1/2 inch and larger with operating temperatures greater than 140°F: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor retarder jacket.

D. At hangers and supports, provide a high density foam insulation insert that extends 2” beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic. Also reference specific requirements in Section 22 05 29, Part 3 Execution.

3.3 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

A. Section 01 91 00 - General Commissioning Requirements

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the plumbing system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
      a. CBCP - Certified Building Commissioning Professional - AEE
      b. CCP - Certified Commissioning Professional - BCA
      c. CPMP - Certified Process Management Professional - ASHRAE
      d. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide As-built drawings and documentation to facilitate Testing.
   7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   9. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   10. Provide data concerning performance, installation, and start-up of systems.
   11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
14. Provide qualified personnel to assist and participate in Commissioning.
15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
21. Coordinate and provide training of Owner's personnel.
22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.
23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
    1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
    2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.
    3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.

4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.
6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Equipment to be tested
1. Energy Management and Control System interface with applicable plumbing system equipment.
2. Service water heating systems (100%).
3. Service water circulation equipment (100%).
4. Domestic water booster pumps (100%).

C. Testing functions and conditions
1. Verify shutdown of systems when scheduled.
2. Calibration of sensors
3. Confirm functionality of all specified sequences of operations.
4. Verify the functionality of all alarms.

D. Performance criteria
1. Water temperatures shall be within tolerances specified in the contract documents.
2. Water heating system “recovery” rates shall be within specified time frame.
3. Booster pump shall maintain system pressure within specified tolerance.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor’s responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division’s systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

C. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. Sampling

1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
3. A common sampling strategy is the “xx% Sampling - yy% Failure Rule”, defined by the following example.
    a. xx = the percent of the group of identical equipment to be included in each sample.
    b. yy = the percent of the sample that if failing, will require another sample to be tested.
    c. The example below describes a 20% Sampling - 10% Failure Rule.
    d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
    e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
    f. If 10% of the units in the second sample fail, test all remaining units in the whole group.
    g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F. Re-Testing And Failure To Remedy Deficiencies
1. Despite Contractor’s best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor’s responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor’s responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
    a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor’s control to resolve expeditiously.
    b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor’s request.
    a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA’s expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G. Deferred Testing
1. "Seasonal Commissioning” pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.

2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

D. Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:

1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
   1. Pipe and pipe fittings:
      a. Sanitary drainage piping system.
      b. Domestic water piping system.
   2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors
   3. Valves
   4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

C. Section 22 07 19 - PLUMBING PIPING INSULATION

D. Section 22 11 19 - PLUMBING SPECIALTIES

E. Section 22 30 00 - PLUMBING EQUIPMENT

F. Section 22 40 00 - PLUMBING FIXTURES

1.4 REFERENCES

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

C. ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads; Current Edition.

D. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2018.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

H. ASME B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500; 2021.

I. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

J. ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300; 2019.
K. ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings; 2013.
L. ASME BPVC - Boiler and Pressure Vessel Code; 2023.
M. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
N. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.
O. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
P. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2022a.
Q. ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings; 2022b.
R. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
S. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars; 2022.
T. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples; 2016 (Reapproved 2022).
U. ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints; 2023.
V. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.
W. ASTM B32 - Standard Specification for Solder Metal; 2020.
X. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2020.
Y. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.
Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
AA. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.
BB. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
CC. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
DD. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).
EE. ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems; 2018.
FF. ASTM C1460 - Standard Specification for Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground; 2017.
GG. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
HH. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
II. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

JJ. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.

KK. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2020.

LL. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

MM. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings; 2022.

NN. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

OO. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.

PP. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

QQ. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

RR. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

SS. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019.

TT. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007.

UU. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials; 2021.

VV. ASTM D3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns; 2017 (Reapproved 2021).

WW. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).

XX. ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials; 2012.

YY. ASTM D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems; 2015.

ZZ. ASTM D6707/D6707M - Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications; 2016.

AAA. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

BBB. ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus; 1992 (Reapproved 2018).

CCC. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

DDD. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

EEE. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

FFF. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

GGG. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings; 2021.

HHH. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings; 2019.

III. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems; 2016.

JJJ. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

KKK. ASTM F1548 - Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications; 2001.

LLL. ASTM F1673 - Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems; 2010, with Editorial Revision (2021).

MMM. ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems; 2019.

NNN. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.; 2011 and errata.

OOO. AWS A5.9/A5.9M - Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification; 2017.

PPP. AWS A5.31M/A5.31 - Specification for Fluxes for Brazing and Braze Welding; 2012.

QQQ. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

RRR. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

SSS. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

TTT. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

UUU. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings; 2019.

VVV. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe; 2023.

WWW. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.

XXX. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; 2020.

YYY. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

ZZZ. AWWA C651 - Disinfecting Water Mains; 2023.

AAAA. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.

BBBB. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

CCCC. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

DDDD. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

EEEE. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2025.

FFFF. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

GGGG. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

HHHH. UL 1285 - Safety Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service; 2016.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Foreign pipe, fittings or valves are unacceptable.

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

F. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

G. Welders Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data and video inspection report under provisions of Division One.

C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

D. Submit dimensioned detailed drawings and material specifications for pipe isolation and protection systems being provided for void form/carton form/void box installations.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

C. Include written report and digital video record of waste piping inspection.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage. Pipe and fittings resting on the ground is unacceptable.

E. Provide temporary protective coating on cast iron and steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

B. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

PART 2 - PRODUCTS

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
   1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
   2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, NOT BURIED

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.
   1. Fittings: Cast iron, CISPI 301 or ASTM A888 drainage pattern.
   2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
      a. Tyler Pipe
      b. Charlotte Pipe
      c. AB&I Foundry

3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations. Acceptable manufacturers:
    a. Husky SD 4000
    b. Clamp-All 125

B. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.
1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.

C. Brass Pipe: ASTM B43, chrome plated
1. Fittings: ASME B16.23 cast bronze, chrome plated.
2. Joints: In accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead) or as recommended by the manufacturer.
3. Applies to exposed piping applications (such as kitchens), wherever required by the prevailing code or by the Authority Having Jurisdiction.

2.3 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING EDGE

A. Copper Tubing: ASTM B88, Type K. Provide soft annealed for pipe sizes up to and including 2" and hard drawn for sizes 2-1/2” and larger.
1. Fittings: ASME B16.22 wrought copper pressure fittings.
2. Joints shall be as follows:
    a. No joints shall be permitted for pipe sizes 2” and smaller. All such piping must be run continuous where buried and brought up to no less than 12” above the finished floor before any joint is provided.
    b. For sizes larger than 2”, joints between copper pipe and fittings shall be brazed and shall be made in accordance with all the applicable portions of ASTM B828, manufacturer’s recommendations, and AWS requirements. Brazing filler metal shall be in accordance with AWS A5.8/A5.8M and any required flux shall meet AWS A5.31M/A5.31, Type FB3-A or FB3-C.
3. Beginning at no closer than the 5’-0” mark from the building, all piping buried or in contact with concrete shall be provided with one of the following, which shall also extend to a minimum of 6” above the finished floor:
    a. AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines. Chase Construction Products Tapecoat H35 or approved equivalent.
    b. Continuous polyethylene lining, minimum 60 mil nominal thickness.
4. All domestic water service entries shall be provided in a buried fashion. Service entries outside of the building with wall penetrations above grade are not acceptable.

2.4 DOMESTIC WATER PIPING, WITHIN BUILDING, BURIED

A. Copper Tubing: ASTM B88, Type K, soft annealed.
1. No joints allowed buried, run tubing continuous.

2. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all piping buried or in contact with concrete, to a minimum of 6" above finished floor. Chase Construction Products Tapecoat H35 or approved equivalent.
3. Applies to installations including services to island sinks and trap primer lines.

2.5 DOMESTIC WATER PIPING, WITHIN BUILDING, NOT BURIED

A. Copper Tubing: ASTM B88, Type L, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper alloy solder joint pressure fittings.
   2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.

B. Fittings and joints for pipe sizes 1/2" through 4" may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer's approved press tools, kits, and jaws shall be used.
   1. EPDM o-rings shall be pre-installed and lubricated with NSF 61 listed lubricant.
   2. All installers of copper press-connect fittings shall be trained by the fitting manufacturer's appointed representative and carry such credentials for the duration of the project.
      a. The fitting manufacturer's representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer's recommended installation practices.
   3. Acceptable system manufacturers: Viega only.

2.6 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A. (Non-Acid Waste) Drainage Applications:
   1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.
   2. **Not buried:** For dissimilar piping not buried, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to the building floor where piping below is buried.
      a. Husky 4200 or Cremco
      b. Fernco Proflex
   3. **Buried, but NOT below building slab**: For dissimilar buried piping beyond the limits of building or readily accessible buried piping transitions in backwater valve pits, etc. Provide shear resistant .012" thick 300 series stainless steel shielded, **PVC gasketed** flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.
      a. Cremco
      b. Mission Rubber Company, LLC
      c. Fernco, Inc. Strong Back RC 1000 Series

4. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23 / ASME B16.29.

B. Domestic Water Applications:
1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable standards ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.24, ASME B16.50 ASME B16.50, ASME B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
3. Buried to not buried transitions for water service entries:
    a. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
    b. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
4. Dielectric connections:
    a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
    b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.
    c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:
1. Unions for ferrous pipe shall be ASME B16.39 galvanized malleable iron, threaded, minimum pressure class 150.
2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.
3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53/A53M welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865/A865M.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.
6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16" thick pre-formed neoprene, typical.
7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer's recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

2.7 BALL VALVES

A. All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. Basis of design (bronze valves):
   1. NIBCO T-585-66-LF (full port) for all sizes up through 2”.
   2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2” and 3”.

C. Valves 4” and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D. Acceptable alternate manufacturer, **only if** press-joining of copper piping is employed:
   1. Viega ProPress Model 2971.1ZL for sizes up through 2".
   2. Viega ProPress Model 2971.1XL for sizes 2-1/2" - 4" (with chrome-plated ball)

E. Applies to domestic water system installations.

F. Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G. Provide valves complete with memory stop kit where used for balancing applications.

2.8 BALANCING VALVES

A. Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. The valve set-point (closing temperature) shall be the hot water system supply temperature. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free NSF 372 and NSF 61 compliant. Threaded connections.

B. Basis of design:
   1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2”. Provide a union and ball type shutoff valve on both sides of the balancing valve.
   2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.
   3. Provide complete with an integral check valve from the manufacturer, positioned after the balancing valve. For balancing valves not available with an integral check valve as part of the manufacturer's assembly, ensure to provide a lead-free swing type check valve on the downstream side of the balancing valve component.

C. Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.
   1. Provide balancing valve at end of each domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer’s installation recommendations.

2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.1 EXCAVATION, BEDDING AND BACKFILL

A. This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.

B. Establish elevations of buried piping outside the building to ensure the following:
   1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.
   2. For water lines intended for fire protection service, the depth of cover shall be:
      a. Not less than 2’-6” in those locations where frost is not a factor.
      b. Not less than 1’-0” below the frost line for the locality.
      c. Not less than 3’-0” for piping under driveways.
      d. Not less than 1’-0” below the bottom of the building foundation/footers.
      e. In full compliance with the requirements of NFPA 13 and NFPA 24.

3.2 INSTALLATION

A. General requirements for piping:
   1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
   2. Remove any scale, oil and dirt, on inside and outside, before assembly.
   3. Prepare piping connections to equipment with flanges or unions.
   4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.
   5. All-thread pipe nipples are not allowed.
   6. Threaded nipples smaller than 1/2" diameter shall be schedule 80.

B. General requirements for valves:
   1. Install valves with stems upright or horizontal, not inverted.
   2. Valves shall be line-sized unless specifically noted otherwise.
   3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.
   4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
   5. Locate above-ceiling valves over accessible areas as practical to ensure full operability and accessibility, within 18" of ceiling plane so that they are in easy reach.
   6. Gate valves installed buried shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C. Install all materials in accordance with the manufacturer's published instructions.

D. Unburied piping inside the building shall be installed concealed, out of public view wherever possible (above ceilings, inside walls and chases, within casework, etc.). This requirement shall not apply to fixture supplies & stops and chrome plated tubular brass drainage piping.

E. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

F. Provide non-conducting dielectric connections wherever joining dissimilar metals.

G. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

H. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

I. Group piping whenever practical at common elevations.

J. In athletic areas, where more than one unconcealed horizontal pipe is routed alongside each other via common hangers (a "rack" or trapeze arrangement), steps shall be taken to prevent the space between the parallel pipes from being a potential collecting point for thrown balls, etc. Provide a horizontal network of wire rope aircraft cable (or similar product) with associated hardware in the space immediately above the piping in a criss-crossed or equivalent fashion to act as a barrier.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

L. Ensure expansion loops or similar are provided where piping crosses building expansion joints. Reference Section 22 05 16 for addtional information.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Provide encasement for and support for utility meters in accordance with the requirements of utility companies.

O. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

P. Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

Q. Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

R. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

S. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

T. General requirements for cast iron piping installation:
   1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.
   2. Install bell and spigot type pipe with bell end upstream.
   3. Above ground horizontal pipe (suspended) shall:
      a. Be supported at no less than at every joint, and within 18” of the hub or coupling.
      b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.
      c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.
      d. Have all closet bends, traps, trap arms, and similar branches firmly secured.
      e. Be braced to prevent movement or joint separation.
      f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.
   4. Above ground vertical pipe shall:
      a. Be secured at each stack base.
      b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.
      c. Be adequately supported to keep the system (pipe and contents) in alignment.
   5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

U. All grooved system tools and components (couplings, adapters, fittings, gaskets, and specialties) shall be the product of a single domestic system manufacturer.

V. Grooved pipe system manufacturer shall provide on-site training for contractor’s field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.3 APPLICATION

A. Provide union downstream of all valves at equipment or apparatus connections.

B. Provide unions downstream of all threaded isolation valves in the domestic water system to facilitate any future valve replacement.

C. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

D. Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:
   1. At the domestic water service entry.
   2. At each wing of the building.
   3. At each floor for each domestic water tap branching off from a vertical riser.
   4. At each domestic water branch line capped for future use.
   5. At each restroom or restroom group.
   6. At each science classroom.
   7. At each hose bibb, wall hydrant, roof hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices). For exterior wall hydrants, ensure to locateprovide valves within 5'-0" of the exterior wall.
   8. At each domestic water branch line within 24” of the corresponding main.
   9. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.
   10. At each kitchen or similar food service space.

E. Each plumbing water rough-in stub out shall be fitted with a supply stop.

F. Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

G. Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.4 ERECTION TOLERANCES

A. All gravity drainage piping shall be provided at a uniform and continuous slope in accordance with the prevailing plumbing code and as described below. If any of the criteria below conflicts with the prevailing code then the code requirements shall govern:
   1. Gravity piping 3" and smaller shall be provided at no less than 1/4" per foot slope.
   2. Gravity piping 4" and larger shall be provided at no less than 1/8" per foot slope.
   3. Where the code allows for a shallower slope than indicated above, this shall be allowed if required per project conditions.
   4. Where the code requires a steeper slope than inidcated above (such as for grease waste piping) than such requirements shall control.

B. All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C. Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.7 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.8 VIDEO INSPECTION AND DOCUMENTATION

A. It shall be the responsibility of the plumbing contractor to retain the services of a qualified, independent company (other than the installing plumbing contractor) with no less than ten (10) years of experience in digital video camera inspection/investigation of plumbing drainage waste and vent lines for commercial/institutional building projects.

B. The independent company shall perform a complete video camera inspection of all storm and waste piping buried inside the building. This shall include sanitary waste and any specialty waste (grease waste, oily waste, etc.) systems and shall extend from the building all the way to any associated outdoor traps/interceptors.

C. All video inspection shall be conducted in the presence of Fort Bend ISD personnel.

D. The independent company shall create a permanent digital video record of their inspection with accompanying definitive identification (audio or visual) to indicate different systems and different areas of the systems inspected.

E. The independent company shall prepare a comprehensive written report including, but not necessarily limited to, the following:
   1. Complete company contact information.
   2. Project name and address.
   3. Date(s), time(s), and conditions during the inspection(s).
   4. Name(s) of the operator(s) performing the inspection(s).
   5. A general summary of the inspection results.
   6. A written description of any and all material and/or installation deficiencies or irregularities found, with accompanying pictorial documentation. This shall include conditions such as:
      a. Deformed or damaged piping
      b. Full or partial blockage of piping
      c. Deleterious material or debris within the piping
      d. Slope deficiencies (inadequate, inconsistent, or absent slope)
      e. Valleys or “dips” in the piping
      f. Improper fittings in the piping including reductions in pipe size in the direction of flow

F. The written report shall be submitted under this Section but separately from other submittals of this Section. This shall occur immediately prior to substantial completion.

G. The written report and the digital video record (DVD or USB flash drive) shall also be submitted as part of the Project Record Documents.

3.9 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:
   1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
   2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.
   3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.10 COMPLETE FUNCTIONING OF WORK

A. All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 22 11 19 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the specialties covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
1. Hose Bibbs and Hydrants
2. Backflow Preventers
3. Water Hammer Arresters
4. Strainers and Filters
5. Thermostatic Mixing Valves
6. Floor Drains and Floor Sinks
7. Cleanouts
8. Trap Primers

1.3 RELATED WORK

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 10 00 - PLUMBING PIPING

C. Section 22 30 00 - PLUMBING EQUIPMENT

D. Section 22 40 00 - PLUMBING FIXTURES

1.4 REFERENCES

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.1070 - Performance requirements for water temperature limiting devices; 2020.

C. ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2004.

D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.

F. ASSE 1060 - Performance Requirements for Outdoor Enclosures for Fluid Conveying Components; 2017 (Reaffirmed 2021).

G. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves; 2020.

H. {RSTEMP#412}

I. ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment; 2012.

J. {RSTEMP#1919}

K. ASME A112.6.7 - Sanitary Floor Sinks

L. ASSE 1057 - Performance Requirements for Freeze Resistant Sanitary Yard Hydrants with Backflow Protection

M. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves

N. AWWA C510 - Standard for Double Check Valve Backflow Prevention Assembly

O. NSF 61 - Drinking Water System Components - Health Effects

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit shop drawings and product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment and backflow preventers.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Indicate frequency of treatment required for interceptors and separators.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two loose keys for hose bibbs and hydrants and spare hose end vacuum breakers.

1.11 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes, and corrections.
   6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A. Conform to applicable codes for the provision and installation of all required backflow prevention devices.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

C. Provide backflow prevention assembly test and maintenance report for all devices. A printed and signed form by the licensed tester that performed the work shall be provided both to the Owner and to the Public Water System in accordance with TCEQ (Texas Commission on Environmental Quality) requirements.

PART 2 - PRODUCTS

2.1 HOSE BIBBS/HYDRANTS

A. General: Provide an operating handle for each loose keyed device on the project.

B. Hose Bibb: Bronze or brass construction, replaceable stem assembly, hose thread spout, complete with vandal resistant lockshield and ASSE 1011 integral vacuum breaker. Provide chrome plated and with removable key where exposed in public areas.

C. Wall Hydrant: Bronze or brass construction, replaceable stem assembly, hose thread spout, non-freeze, self-draining type with integral vacuum breaker. ASSE 1019. Unless specifically noted otherwise, provide recessed complete with heavy cast aluminum or nickel plated brass lockable box and loose key operator.

D. ACCEPTABLE MANUFACTURERS:
   1. J.R. Smith
   2. Zurn
   3. Mifab
   4. Watts
   5. Wade
   6. Josam
   7. Chicago (interior use hose bibbs only)
   8. Woodford
   9. Prier

2.2 RECESSED VALVE BOX

A. Washing Machine: Pre-formed galvanized or stainless steel rough-in box with brass long shank valves with wheel handles, threaded drain fitting for waste, and matching secured faceplate. PVC constructed box, faceplate, and bracket will be acceptable within dwelling units only, in residential occupancies only.

B. ACCEPTABLE MANUFACTURERS:
   1. Guy Gray
   2. Mifab
   3. Sioux Chief
   4. Oatey

2.3 WATER HAMMER ARRESTERS

A. Engineered water hammer arresters: ASSE 1010 listed, lead-free, pre-charged, permanently sealed, maintenance- free, suited for concealed installation, with a working temperature range of 33 to no less than 212 degrees F and a maximum working pressure of no less than 250 psi during pressure surges. Stainless steel or copper body construction. Shall be sized and located in accordance with Plumbing Drainage Institute standard {RS#1919}.

B. ACCEPTABLE MANUFACTURERS:
   1. J.R. Smith
   2. Zurn
   3. Mifab
   4. Wade
   5. Josam
   6. P.P.P.
   7. Sioux Chief

2.4 THERMOSTATIC MIXING VALVES

A. Provide thermostatic mixing valves in accordance with manufacturer’s recommendations and as indicated and scheduled on Drawings.
   1. Unless scheduled otherwise, all units other than under-counter point of use units shall be provided complete in lockable cabinet of 16 gage (1.5 mm) prime coated steel when located in finished areas.
   2. All under-counter point of use units shall be provided complete with integral checks and dual stainless steel strainers on inlets for protection against fouling.

B. Types and Requirements:
   1. Where hot and cold water is supplied to emergency safety fixtures, the temperature shall be controlled by a temperature actuated mixing valve complying with ASSE 1071.
   2. Valves for individual showers are addressed in Section 22 40 00 - PLUMBING FIXTURES
   3. (Master) mixing valves serving multiple showers, each with a single tempered water supply pipe, shall conform to ASSE 1069 or CSA B125.3. Such valves shall be provided complete with unions, checks, and ball valves at all connections as well as a temperature gauge on the outgoing water line.
   4. Mixing valves serving (athletic area) whirlpool applications shall conform to {RS#412} / ASME A112.1070 / CSA B125.70 or CSA B125.3. Such valves shall also be configured with appurtenances as described above.
   5. Mixing valves supplying tempered water to lavatories and sinks shall conform to {RS#412} / ASME A112.1070 / CSA B125.70 or CSA B125.3.

C. ACCEPTABLE MANUFACTURERS:
   1. Bradley

2. Powers
3. Symmons
4. Acorn

2.5 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains and floor sinks in accordance with manufacturer's recommendations, as appropriate for floor construction per ASME A112.6.3, and as indicated and scheduled on Drawings.

B. Provide clamping devices for all drains in membrane floor areas.

C. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith
2. Zurn
3. Mifab
4. Josam

D. Provide drains of suitable and compatible material for specialized piping systems conveying acid waste.

2.6 CLEANOUTS

A. General: Provide cleanouts as indicated and scheduled on Drawings and also as required by the prevailing code, whether shown on the Drawings or not.

B. Construction: All cleanouts shall have tapered PVC, ABS, or polypropylene plugs.

C. Provide clamping devices for all cleanouts in membrane floor areas.

D. Provide cleanouts of suitable and compatible material for specialized piping systems conveying acid waste.

E. Types:
1. Finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel bronze scoriated top.
2. Resilient or tile finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.
3. Interior finished wall cleanouts: Provide cast iron tee body or cleanout ferrule as required for wall construction and provide counter-sunk plug with stainless steel access cover and securing screw(s).
4. Interior unfinished accessible cleanouts: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

F. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

2.7 TRAP PRIMERS

A. General: Provide trap primers as indicated and scheduled on Drawings and in accordance with manufacturer's recommendations.

B. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith

2. P.P.P.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to provide intended performance.

B. Install equipment specific drains appropriately located to serve the equipment. Drain placement shall not conflict with housekeeping pads, casework, equipment access, clear space for foot travel, etc. In kitchens and similar settings final drain locations must be carefully coordinated to ensure that equipment casters, table legs, etc. do not bear upon drain grates.

C. Water hammer arresters:
   1. The contractor shall provide water hammer arresters as shown on Drawings and also in accordance with {RS#1919}, whether shown on Drawings or not.
   2. Water hammer arresters shall be PDI certified and sized and placed as recommended by manufacturer.
   3. Provide above lay-in ceiling, within chase or wall or above solid ceiling complete with access panel, or otherwise accessible location complete with isolation valve to facilitate replacement.
   4. Provide for both domestic hot and cold water services.
   5. The provision of air chambers for the control of water hammer shall not be acceptable, but for within dwelling units only, in residential occupancies only.

D. Backflow preventers:
   1. Provide strainers at all backflow preventers.
   2. Contractor shall certify all newly installed backflow preventers and provide proof of certification to the Owner.
   3. Pipe relief line from backflow preventer via manufacturer’s air gap assembly, full size to nearest suitable drain. Such routing shall not pose a trip hazard. Where a suitable drain of appropriate size is not provided, route line to the outdoors.
   4. All backflow preventers shall be securely supported with wall supports and/or pipe stands as appropriate for the size and weight of the unit and shall be installed with sufficient access and clearance for testing and maintenance. Unless specifically noted otherwise on Drawings, all backflow preventers shall be installed at 48”-60” above finished floor.
   5. Unless specifically noted otherwise on the Drawings, outdoor installations shall be housed within an appropriately sized, ASSE 1060 Class I freeze and vandal protective insulated, marine grade aluminum constructed enclosure complete with drain panel and removable/movable panel(s) for device maintenance and testing. Provide complete with manufacturer's recommended electric heater. Safe-T-Cover by Hydrocowl.

E. Cleanouts:
   1. Provide two-way cleanouts at all waste outfalls from the building.
   2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at all cleanouts for access and for rodding of drainage system.
   3. Wall cleanouts provided at the end of horizontal piping runs shall be installed vertically above the flow line of the pipe served.
   4. All cleanouts outside of building on grade shall be set in an 18" x 18" x 4" thick concrete pad, flush with final grade/paving.
   5. All cleanouts shall be the same nominal size as the pipe they serve, up to 4 inches. For pipes larger than 4 inches, provide a 4 inch cleanout.

F. Trap primers:
   1. In unfinished areas such as mechanical rooms, such devices may be installed exposed.

2. In finished areas, all devices must be installed concealed from public view. If not readily accessible (such as above a lay-in ceiling) ensure to provide an access door.

END OF SECTION

SECTION 22 11 21 - NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping system covered by this section, with all appurtenances, ready for the Owner's use. This shall include, but not necessarily be limited to, the following:
   1. Pipe and pipe fittings.
   2. Adapters, transitions, final flexible connectors.
   3. Valves, regulators, and regulator vents.
   4. Metering.
   5. Testing.

B. Coordinate in advance with the local gas utility provider and:
   1. Ensure an unobstructed and acceptable pathway for the incoming gas service.
   2. Ensure compliant gas meter location(s) with all required clearances and maintenance access.
   3. Pay for all fees & inspections and secure all necessary permits required for a complete and operating gas service to the project.

1.3 RELATED WORK

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

C. Section 22 30 00 - PLUMBING EQUIPMENT

1.4 REFERENCES

A. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

D. ASME B31.1 - Power Piping; 2024.

E. ASME B31.8 - Gas Transmission and Distribution Piping Systems; 2022.

F. ASME BPVC - Boiler and Pressure Vessel Code; 2023.

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

I. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications; 2023.

J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

K. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

L. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

M. NFPA 54 - National Fuel Gas Code; 2024.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Foreign pipe, fittings or valves are unacceptable.

E. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

F. Welders Certification: In accordance with ASME BPVC-IX.

G. Materials, design, fabrication, and testing-inspection shall conform to the requirements of ASME B31.1.

1.6 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include pipe materials, pipe fittings, valves, regulators, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves, regulators, and meter(s).

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary protective coating on steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform and provide all work in accordance with plumbing and building codes having jurisdiction.

B. Ensure compliance with fire marshal, utility provider, and Texas Railroad Commission requirements.

C. All sleeves passing through return air plenum space shall be of compliant material.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. All gas piping not buried shall be ASTM A53/A53M schedule 40 black steel pipe as manufactured by U.S. Steel Tubular Products, Republic Steel, Youngstown Pipe & Steel, or approved equal domestic manufacturer.

B. All gas piping larger than 2” shall have welded fittings. Threaded fittings and joints will only be permitted for sizes 2" and smaller. Unions and valves will not be permitted above ceilings or in walls or chases.

C. All steel pipe fittings shall be as follows:
   1. All dimensions and design for forged steel fittings shall conform to ASME B16.11.
   2. The material for all forged carbon steel fittings shall conform to ASTM A105/A105M.
   3. All welding fittings shall be factory-made and shall be full line size, for each tee, branch, elbow, etc., with reducers after fittings, if required.
   4. All threads shall be taper pipe threads and conform to ASME B1.20.1.
   5. All threaded fittings shall be ASME B16.3 Class 150 malleable iron by Ward Manufacturing or approved equal domestic manufacturer. Threaded joints shall be made up with graphite and oil or Teflon tape.
   6. All pipe fittings shall be from a domestic manufacturer.

D. All gas piping buried outside the building with 5 pound working pressure or less shall be as follows:
   1. The pipe shall be PE 2708/2406 yellow medium density polyethylene (MDPE) with socket heat fusion joints and fittings per ASTM D2513. Pipe sizes 1/2" through 6" shall be SDR 11.
   2. All socket heat fusion fittings shall be D.O.T. approved and meet ASTM D2513, ASTM D2683 and ASME B31.8 codes.
   3. All gas valves below grade shall be ASTM D2513 polyethylene constructed ball type with NBR seat and seals, rated for natural gas use. Hubbell/Lyall or approved equivalent. All such valves shall be placed in a cast-iron valve box of an adequate size for accessibility and maintenance.
   4. All transition meter risers shall be 100% pressure tested, D.O.T. approved, IAPMO/UPC and CSA listed, anodeless service type, fusion coupled only. All gas carrying steel parts shall meet or exceed ASTM A53/A53M and all polyethylene components shall conform to ASTM D2513. Electrostatically bonded epoxy coated exterior steel casing. Hubbell/Continental Industries or approved equal.
   5. The contractor shall take thermal expansion under consideration during installation. The contractor shall follow all requirements set by the manufacturer to protect the system from damage due to thermal expansion.
   6. The contractor shall provide detector tape approximately 12" above all gas piping.
   7. Wrap pipe with 18 gauge minimum copper tracer wire. Tracer wire shall be secured to piping where it extends above buried location and tagged.

E. Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve where required by the building code.

F. Gas valves shall be UL listed as follows:
   1. Ball valves:
      a. Basis of design: Nibco T585-70-UL for 1/4” to 1” and T580-70-UL for 1-1/4” to 3”.
      b. Acceptable alternate manufacturers: Apollo, Milwaukee.
   2. Plug Valves: ASTM A126 cast iron quarter turn plug valve with no less than 175 psi maximum cold working pressure (CWP).
      a. DeZurik Eccentric plug valve
      b. Flowserve/Nordstrom short pattern all-iron lubricated plug valve, Super Nordstrom or Nordstrom Bolted Gland type.

G. Gas pressure regulators:
   1. Shall be capable of reducing the incoming gas pressure to the intended outgoing gas pressure at the capacities required by the system gas demand.
   2. Shall be installed in accordance with manufacturer's recommendations, accessible for servicing, and protected against physical damage accordingly.
   3. Shall not be located above ceilings or in similar installations.
   4. Shall be provided with factory-installed overpressure protection devices (OPD's) where required. Reference NFPA 54, Section 5.8 in particular.
   5. Line pressure regulators shall be listed in accordance with ANSI Z21.80/CSA 6.22.
   6. Each regulator shall be provided complete with:
      a. An upstream shutoff valve
      b. A capped test tee fitting oriented downward for sediment trap and testing purposes, located between the regulator and upstream shutoff valve
      c. Unions on both sides of and within 1 foot of the regulator
      d. A capped test tee fitting not less than 10 pipe diameters downstream of the regulator outlet, for testing purposes

7. Shall be as manufactured by Sensus/Rockwell, Emerson/Fisher, Maxitrol, or approved equal.

H. All gas regulators located inside the building shall be vented to the outdoors with schedule 40 black steel pipe. This includes all regulators provided with mechanical and plumbing equipment and all other regulators provided under this contract.
   1. Vent piping shall be the full size of regulatory port opening, or as recommended by the regulator manufacturer.
   2. Each vent shall be run independently of any other regulator vents.
   3. Each vent shall terminate at a height and in a location no less than 10'-0" from any door/window/outside air intake and no less than 3'-0" from a possible source of ignition.
   4. Each vent shall be located and designed to prevent the entry of water, insects, or other foreign materials that could cause blockage. Each vent shall terminate with an elbow oriented downward, fitted with 12x12 mesh stainless steel screen in the outlet.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. All piping, valves, and appurtenances shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. All underground gas piping shall be laid on 6" of wet compact banks and approximately 24" below grade and buried in a manner to protect it from damage. Backfill trench with wet compacted banksand to 6" above pipe. The remainder of backfill shall be selected backfill and shall meet all compaction requirements set forth by the general trenching and backfill requirements.

D. Provide lever handle gas valve, drip leg and union at each piece of equipment and where indicated.

E. At kitchen appliances provide commercial grade, ANSI Z21.69/ANSI Z21.24 compliant flexible connections, stationary or moveable (as necessary for the equipment served) of suitable lengths.

F. All gas lines entering building shall be valved on the exterior of the building above grade. All gas lines entering (or leaving) buildings shall be sleeved through the exterior wall above grade and sealed watertight.

G. Refer to Section 22 05 53 for valve and piping identification requirements, including painting and labeling (pipe markers). Provide as specified.

H. Refer to Section 22 05 29 for pipe hanger and support requirements. Provide as specified.

I. Gas piping shall not be routed through or beneath a building slab unless specifically indicated as such on the Drawings. For such installations:
   1. The gas piping shall be sleeved, sealed, and vented to the outdoors in accordance with the requirements of NFPA 54 or the prevailing gas code, or whichever is the more stringent requirement.
   2. All sleeves must be of suitable material for the installed location. This shall include, but is not necessarily limited to, providing sleeves of compliant material and construction where passing through return air plenum spaces.

J. Provide an accessibly located valved and capped test tee for each distinct system to facilitate regular pressure testing of all gas piping from the outlet of the meter to each inlet valve of each appliance. Reference Texas Administrative Code Title 16, Part 1, Chapter 8, Subchapter C, Rule 8.230 for additional information as necessary.

3.2 TESTING OF GAS PIPING SYSTEMS

A. All gas system testing shall be in compliance with local codes or as required in NFPA 54 National Fuel Gas Code, whichever is the more stringent requirement. Additionally, in school facilities all such testing shall be performed in accordance with the Texas Administrative Code, Railroad Commission of Texas testing requirements for natural gas piping systems. Reference Rule 8.230 in particular.

B. All work shall be performed by a Journeyman Plumber holding current State and local licenses.

C. All tests shall be accomplished during normal working hours and after having given due notification to building owner, construction manager or designee, of tests to be performed. All tests shall be performed in the presence of and witnessed by the building owner's representative or designee.

D. All gas system piping shall be subjected to a pneumatic test pressure of 60 psig for not less than 2 hours upon completion of all rough-in work and prior to covering. While the systems are subjected to this air pressure test, all joints shall have a soapy water solution applied and shall be observed for leaks. During test period there shall be no perceptible drop in test gage pressure.

E. A final test shall be performed after all portions of the piping system are completely installed and covered. The entire system shall be tested, with all system outlets plugged or capped, before any equipment or appliances are connected to the piping.
   1. Final test shall be with mercury, measured with a manometer or slope gage. Test pressures shall in no case be less than one and one half times the normal operating pressure or as listed below; which ever is the greater:
      a. 10.5 inches mercury (5 psig) for systems designed for 0.25 psig or less
      b. 21.0 inches mercury (10 psig) for systems designed for greater than 0.25 psig
   2. Tests shall prove absolutely tight, showing no perceptible drop for the entire test period, which shall be as follows:
      a. No less than 30 minutes for systems designed for less than 5 psig
      b. No less than 60 minutes for systems designed for 5 psig or greater

F. Purge air from test piping before connecting equipment or appliances. Purge air to outdoors or to ventilated space of sufficient volume to prevent accumulation of flammable mixtures.

END OF SECTION

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all appurtenances, ready for the Owner’s use.

B. Include the following work in addition to items normally part of this Section:
   1. Domestic Water Heaters
   2. Water Softeners

1.3 RELATED SECTIONS

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 10 00 - PLUMBING PIPING

C. Section 26 05 19 - WIRE, CABLE AND RELATED MATERIALS

1.4 REFERENCES

A. 10 CFR 430, Appendix E to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Water Heaters; Current Edition.

B. ANSI Z21.10.3 - Gas-Fired Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2015.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 54 - National Fuel Gas Code; 2024.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Perform Work in accordance with Authorities Having Jurisdiction.

C. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

D. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. National Sanitation Foundation (NSF).
   2. American Society of Mechanical Engineers (ASME).
   3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
   4. National Electrical Manufacturers' Association (NEMA).
   5. Underwriters Laboratories (UL).
   6. American Society of Plumbing Engineers (ASPE)

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:
   1. Include dimensions of tanks, tank lining and insulation methods, anchors, attachments, lifting points, sizes and locations of all connections and drains.
   2. Include water softening equipment dimensions, sizes and locations of all connections, performance data and capacities, backwash requirements.
   3. Include manufacturer’s recommended space requirements, clearances, and maintenance access.

C. Product Data:
   1. Provide electrical characteristics and power and controls connection requirements/capabilities.

D. Manufacturer's Installation Instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment.

C. Provide written start-up reports.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 22.

B. Operation Data: Include manufacturer’s operating instructions, common trouble conditions and remedies, and trouble-shooting protocols.

C. Maintenance Data: Include routine maintenance items and corresponding intervals, identify typical replacement parts including part numbers and availability. Provide location and full contact information including after-hours maintenance/support telephone numbers for manufacturer authorized maintenance and repair companies.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled equipment to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of equipment to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept equipment on site in original factory packaging. Inspect for damage. Damaged equipment shall not be acceptable.

D. STORAGE: Store equipment in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two sets of electric water heater elements.

1.11 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval.

B. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes, and corrections.
   6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A. Conform to AGA, NSF, NFPA 54, NFPA 70 and UL 1453 requirements for water heaters.

B. Conform to ASME BPVC-VIII-1 for manufacture of pressure vessels for heat exchangers.

C. Conform to water heater minimum efficiency requirements prescribed by ICC (IECC) and ASHRAE Std 90.1 I-P

D. Water heaters shall be tested and rated in compliance with 10 CFR 430, Appendix E to Subpart B or ANSI Z21.10.3 as applicable.

1.13 WARRANTY

A. Provide one year warranty under provisions of Division One, unless specifically noted otherwise.

B. Warranty: Include coverage of domestic water heaters and packaged systems, water storage tanks, water softeners, and domestic pressure booster systems.

PART 2 - PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS (STORAGE TYPE)

A. Acceptable Manufacturers:
   1. A.O. Smith
   2. State
   3. Bradford White

B. Type: Factory-assembled and wired, electric, vertical storage.

C. Tank: Glass lined welded steel; 4 inch diameter inspection port (when applicable), thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic water thermostat with externally adjustable temperature range from 110 to 170 degrees F (approximate, based on element configuration), replaceable elements of zinc plated copper or nickel chromium alloy, high temperature limit cutoff, enclosed controls and electrical junction box.

E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

F. Provide training per 1.11.

2.2 WATER SOFTENER

A. Acceptable Manufacturers/Equipment Providers:
   1. Unity
   2. Marlo, Inc.

B. Performance:
   1. The water softening equipment shall have the minimum capacity and performance as scheduled on the Drawings.

C. Tanks:
   1. Design tanks for a minimum working pressure of 100 psi.
   2. Design the side shell height to allow a minimum free-board space of 50% of the mineral bed depth for adequate expansion during backwashing.
   3. Fiberglass tanks shall be constructed of non-corroding fiberglass reinforced plastic construction, complete with NSF and UL listed liner.

D. Collector:
   1. Provide the softener with an approved lower distribution system.
      a. Non-clogging strainers to collect soft water and distribute the backwash water.
      b. Covered with a minimum of 3" of 1/8" x 1/16" gravel to ensure even distribution of water.

E. Brine System:
   1. Provide a combination salt storage and brine measuring tank with cover.
      a. Large enough to hold salt for at least 10 regenerations of full salting between refills.
      b. Molded of corrosion free, rigid polyethylene.
   2. Equip the brine tank with:
      a. An elevated salt plate for the collection of concentrated brine.
      b. A suitable chamber for housing an automatic air eliminator safety valve.

F. Automatic Controls:

1. Provide a multi-port main control valve or nest of diaphragm valves.
    a. Hydraulically actuated.
    b. Four position type.
    c. Accomplish the regeneration steps of backwash, brine-slow rinse, rapid rinse and service.
    d. Include fixed and self-adjusting flow regulators necessary to properly control the rate of flow during the backwash and brine-rinse.
    e. Pressures between 30 and 120 psi.
    f. Designed to prevent hard water bypass to service during the regeneration cycle.
    g. Side mount control valves shall be connected with factory pre-piped galvanized piping with dielectric connectors.
2. Control regeneration by a flow sensor with push-button manual override.
    a. Permit regeneration at any time of day or night, any day or every day of the week.
    b. Make provision for individual adjustment of the backwash and brine-rinse cycles.
    c. Provide outputs to the BMS system from the electronic controller of general alarm conditions and flow sensor data.
3. Enclose control mechanisms in a gasketed moisture resistant case, rated as a NEMA III or NEMA 12 enclosure and conforming to UL specifications.

G. Automatic Brine System:
1. Provide a control system to:
    a. Open to admit brine.
    b. Close to prevent the entrance of air.
    c. Refill the brine tank with the proper amount of water.
2. Accomplish regulation of the brine dosage by adjustment of a salt dosage dial in the time clock case.
3. Design the system to allow proper refilling regardless of the salt level in the brine tank.
4. Furnish a float-operated safety valve as standard equipment to safeguard against brine tank overflow.

H. Mineral:
1. Charge the system with a mineral of the type designed as NSF grade non-phenolic polystyrene chlorine resistant resin.
    a. Minimum exchange capacity of 30,000 grains per cubic foot when regenerated with 0.5 lbs. of salt per 1,000 grains of exchange capacity.
    b. A solid, of the proper particle size, (not more than 1.8% through 50 mesh U.S. standard screens, wet screening).
    c. Contain no agglomerates, shells, plates or other shapes which might interfere with the normal function of the water softener.

I. Water Testing Equipment:
1. Provide a sample cock installed for obtaining samples of the effluent water.
2. Provide a complete water testing kit for conducting a water hardness titration test.
3. Provide inlet and outlet pressure gauges.

J. Installation and Training:
1. Softener(s) and brine tanks shall be provided on concrete housekeeping pads.
2. Equipment shall be properly supported and anchored per the manufacturer's recommendations or as needed for stability.
3. Provide training per 1.11.

2.3 IN-LINE CIRCULATOR PUMPS

A. Acceptable Manufacturers:
   1. Grundfos
   2. Bell & Gossett
   3. Armstrong
   4. Taco
   5. Aurora

B. Type: Canned motor type.

C. Housing: Bronze or stainless steel, rated for 125 psig working pressure.

D. Impeller: 304 stainless steel.

E. Shaft: Stainless steel or aluminum oxide ceramic.

F. Thermal Protection: Internal.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, NFPA 54 and UL requirements.

B. Coordinate with plumbing piping and related work to achieve operating system.

C. Provide venting and vent piping in accordance with both code requirements and manufacturer's recommendations. The material and installation provided must not only be compatible with the equipment served but must also be suited to and acceptable per project conditions. Any material to be provided in a return air plenum must be compliant for such use.

D. Provide a properly sized thermal expansion tank downstream of the associated check valve in the cold water supply to the heater.

E. Provide a thermometer at the hot water outlet piping from each water heater.

F. Provide a line sized shut-off valve in the cold water supply to and in the hot water outlet from each heater, close to each heater.

G. Provide approved heat traps at all storage type water heaters not furnished from the manufacturer with integral heat traps or heat trap nipples.

H. Provide a line size plug cock in the gas supply close to each gas-fired water heater.

I. Provide approved dielectric couplings at all hot and cold water connections to each heater/tank, and at the T&P relief valve connection.

J. All tank type water heaters with more than 20 gallons of storage capacity shall be floor mounted on a concrete housekeeping pad, unless specifically indicated otherwise on the Drawings.

K. Each tank type water heater shall be installed within a suitably sized galvanized drain pan. Securely elevate the base of each heater above the floor of the drain pan with structurally sound, non-ferrous, non-absorbent supports. Drain pan shall have no less than a 3/4" piped drain outlet.

L. All water heater drain lines shall be full size, copper, and routed to indirect waste receptors.

M. Startup:
   1. Startup of all water heaters shall be in strict accordance with manufacturer's recommendations.

2. Ensure that storage type water heaters are full of water and downstream fixtures have been run for no less than 3 minutes in order to purge any trapped air from the water heater tank prior to heater startup.

3.2 WATER SOFTENER INSTALLATION

A. Arrange piping for easy dismantling to permit cleaning and service.

B. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

C. Provide a complete set of instructions covering the installation, operation and servicing of the water softener.

D. Provide system manufacturer start-up service.
1. Provide the services of factory trained service technicians to start up the system. Technicians shall be trained and experienced on the work they conduct. Technician shall possess a current Class III WTS License from TCEQ.
2. Provide and fill the brine tank with enough food grade pellet salt for ten (10) regenerations at maximum brining.
3. Monitor the operation of the softener and set the time clock for an average period between cycles so that regeneration occurs in the early morning hours during a period of zero usage
4. Follow the manufacturer's start up procedures.
    a. Verify interlocks.
    b. Test and verify operation of controls.
    c. Calibrate controls.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fixtures covered by this Section, with all appurtenances, ready for the Owner’s use.

B. Include the following work in addition to items normally part of this Section:
   1. Plumbing Fixtures
   2. Fixture Carriers
   3. Faucets, Supplies, and Trim
   4. Flushometers

1.3 RELATED WORK

A. Section 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

B. Section 22 10 00 - PLUMBING PIPING

C. Section 22 11 19 - PLUMBING SPECIALTIES

D. Section 22 30 00 - PLUMBING EQUIPMENT

1.4 REFERENCES

A. ASME A112.4.3 - Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System

B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

C. ASME A112.18.1 - Plumbing Supply Fittings

D. ASME A112.18.2 - Plumbing Waste Fittings

E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures

F. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures

G. ASME A112.19.2 - Ceramic Plumbing Fixtures

H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures

I. ASME A112.19.7 - Hydromassage Bathtub Systems

J. NSF/ANSI 61 - Drinking Water System Components - Health Effects

K. ANSI Z358.1 - Emergency Eyewash and Shower Equipment

L. ASSE 1016 - Performance Requirements for Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.

M. ASSE 1037 - Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

N. ADA (Americans with Disabilities Act)

O. TAS (Texas Accessibility Standards)

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Warranty: Warrant the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or non-conforming materials and workmanship.

C. Defects shall include, but not necessarily be limited to, the following:
1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, finishes, materials, dimensions, performance information, and accessories.

D. Manufacturer’s Installation Instructions: Indicate assembly and support requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on the Contract Documents.

B. Confirm and field coordinate that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. FBISD GUIDELINES - Manufacturers
   1. Water Closets and Urinals - American Standard, Crane, Kohler, or Eljer
   2. Flush Valves - Sloan, Royal, or Regal (186 or 110 series) with vandal resistant trim
   3. Lavatories and Sinks - American Standard, Crane, Kohler, or Eljer

B. GENERAL: Provide plumbing fixtures in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings. Acceptable manufacturers of each fixture type are as indicated below.
   1. Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise.
   2. Fixture drilling shall match faucet spread and match any related trim and accessories.

C. WATER CLOSETS, URINALS, LAVATORIES (Vitreous China)
   1. American Standard
   2. Kohler
   3. Crane
   4. Eljer

D. SINKS - COUNTER MOUNTED (Stainless Steel)
   1. Elkay
   2. Just
   3. Moen Commercial

E. WASH FOUNTAINS AND SOLID SURFACE LAVATORY SYSTEMS
   1. Acorn
   2. Bradley
   3. Willoughby Industries

F. MOP SINKS
   1. E.L. Mustee & Sons

G. SERVICE SINKS (Enameled Cast Iron) these are traditional style, mounted off-the-floor, with a P-trap standard
   1. American Standard
   2. Kohler
   3. CECO (Commercial Enameling Company)

2.2 FAUCETS, SUPPLIES, AND TRIM

A. GENERAL: Provide faucets, supplies, and trim in accordance with manufacturer's recommendations, as appropriate for fixtures to be served, and as indicated and scheduled on Drawings. Acceptable manufacturers for each type of appurtenance are as indicated below.
   1. Flushometer flush rate shall match gallon-per-flush criteria of fixtures served.
   2. Strainers shall be heavy cast brass chrome plated with matching grid type strainer, with or without overflow as required, 17 gauge seamless brass tailpiece of length determined by installation requirements. Provide complete with washers and brass locknut.
   3. P-traps shall be 17 gauge seamless chrome plated brass, adjustable type. Provide complete with cleanout plug, chrome plated brass slip nuts, wall bend, and wrought brass escutcheon of depth determined by installation requirements.
   4. Angle stops shall be lead-free commercial pattern chrome plated brass, quarter turn ball type with loose key handles. Provide complete with chrome plated copper supply risers and wrought brass escutcheon of depth determined by installation requirements.

5. Toilet seats shall be commercial grade and provided complete with stainless steel posts and self-sustaining check hinges.
6. Pipe trim insulation shall be compliant, white molded vinyl, fade/discoloration-resistant, bacteria/fungal-resistant insulation.
7. Where an exposed flush valve assembly will conflict with the installation height of a grab bar or where there will be insufficient clearance above the top cover of an exposed flush valve for maintenance access relative to the installation height of a grab bar, provide an offset type flush valve tube. Make water rough-in and other adjustments as necessary for a compliant and functioning installation.

B. FAUCETS
1. Chicago
2. T&S Brass

C. SUPPLY STOPS
1. McGuire
2. Zurn
3. Chicago

D. CHROME PLATED TUBULAR BRASS
1. McGuire
2. Zurn
3. Kohler

E. TOILET SEATS
1. Bemis
2. Benke

F. PIPE TRIM INSULATION
1. Truebro
2. McGuire
3. Plumberex

2.3 FIXTURE CARRIERS

A. GENERAL: ASME A112.6.1M; Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise. Fixture carrier foot supports shall be securely anchored to the floor with 1/2” bolts and anchors at all locations.
1. Chair type carriers shall be adjustable, with coated cast iron body with integral no hub waste and vent connections, complete with gasketed adjustable faceplate assembly, adjustable nipple with test cap, neoprene bowl gasket, lugs for floor and wall attachment, threaded fixture studs, and hardware. Provide single or double type of vertical or horizontal configuration as required and with auxiliary inlet as required.
2. Lavatory carriers shall be adjustable, with steel uprights and welded base feet, coated cast iron support brackets, cast or ductile iron concealed support arms, alignment rod, complete with leveling and support hardware. Provide single or back to back configuration as required.
3. Drinking fountain and urinal carriers shall be adjustable, with steel uprights and welded base feet, upper and lower bearing plates, threaded rods, and mounting hardware. Provide single or side-by-side configuration as required

B. ACCEPTABLE MANUFACTURERS
1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

PART 3 - EXECUTION

3.1 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.

B. Coordinate cutting of floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings and as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings for final connections with supply, waste, vent, and storm systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves shall be located above accessible ceilings. If ceilings are not accessible, provide access panels of adequate size to ensure valves are fully accessible and can be fully operated.

F. Provide lockable ball valves in piping serving emergency safety fixtures and clearly label such valves as to the fixtures served.

G. Plumbing fixtures shall be supported by a concealed carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

H. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

I. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

J. All fixtures shall have individual chrome plated heavy pattern loose key quarter-turn cutoff stops on supply lines, complete with escutcheons. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply. A loose key for each stop shall be provided to the Owner.

K. Install each fixture with trap, easily removable for servicing and cleaning.

L. All showers and similar installations shall be installed with type “L” copper pipe between shower valve and shower head rough-in. The termination point shall have a brass drop ear elbow for shower head arm connection. Contractor shall provide proper anchoring support.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Review architectural drawings. Confirm configuration and orientation of shower controls and trim prior to rough-in and installation.

3.4 ADJUSTING

A. Adjust work under provisions of Division One.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and appurtenances.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.7 ADA ACCESSIBLE FIXTURES

A. At all locations required to be accessible, such fixtures, controls, and final installations shall comply with the requirements of ADA and any applicable state accessibility standards. Install fixtures to heights, indicated on architectural drawings.

B. All exposed water supply and drain pipes under accessible lavatories and sinks shall be insulated with securely fastened pipe trim insulation kits of the proper model for the fixtures specified.

C. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with an adjacent accessible fixture, shall be supplied with a matching skirt or apron to lower the underside clearance of the non-accessible fixture equal to that required for accessible fixture.

END OF SECTION

SECTION 23 02 00 - BASIC MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C. Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF SUBSTANTIAL COMPLETION

A. The date of final acceptance shall be the date of substantial completion. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

C. No portion of the total contract will be declared substantially complete until the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

D. The Contractor shall ensure that all ductwork either stored on site or installed in the building is thoroughly sealed to protect against dirt and moisture until such time that the building is deemed by the Owner to be adequately clean to allow for start-up of the associated air handling equipment. Should ductwork not be sealed as specified, then the Contractor shall have such ductwork professionally cleaned to an as-new condition at no cost to the owner.

1.9 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 DELEGATED DESIGN FOR ANCHORAGE OF ROOF MOUNTED EQUIPMENT

A. The Contractor shall engage a qualified professional engineer to design all roof mounted equipment curbs, equipment supports, equipment tie downs, equipment connections, and methods of attachment for components that are to be anchored to the building structure. The design shall comply with wind load and uplift requirements utilizing design criteria per ICC (IBC) and ASCE 7 unless criteria is otherwise indicated in the Construction Documents.

B. Submittal: Signed and sealed engineering analysis data and accompanying details, drawings, and supplemental installation information shall be submitted to the engineer for review.

1.11 APPLICABLE CODES AND STANDARDS

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:
   1. Air Moving & Conditioning Association, AMCA.
   2. American Standards Association, ASA.
   3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
   4. American Society of Mechanical Engineers, ASME.
   5. American Society of Plumbing Engineers, ASPE.
   6. American Society of Testing Materials, ASTM.
   7. American Water Works Association, AWWA.
   8. National Bureau of Standards, NBS.
   9. National Fire Protection Association, NFPA.
   10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
   11. Underwriters' Laboratories, Inc., UL.
   12. International Building Code, IBC.
   13. International Energy Conservation Code, IECC.
   14. International Fire Code, IFC.
   15. International Fuel Gas Code, IFGC.
   16. International Mechanical Code, IMC.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.12 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer’s standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 calendar days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with their respective trade(s) and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.14 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty-day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
   1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
   2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items subject to project requirements:
   1. Coordination Drawings
   2. Common Motor Requirements for HVAC Equipment
   3. Expansion Fittings and Loops for HVAC Piping
   4. Variable Frequency Motor Speed Control for HVAC Equipment
   5. Hangers and Support for Piping and Equipment HVAC
   6. Vibration and Seismic Controls for HVAC Piping and Equipment
   7. Testing, Adjusting, and Balancing
   8. Duct Insulation
   9. HVAC Equipment Insulation
   10. HVAC Piping Insulation
   11. Refrigerant Monitor System
   12. Energy Management and Control System
   13. Above Ground Hydronic Piping
   14. Hydronic Specialties
   15. Hydronic Pumps
   16. Refrigerant Piping
   17. Metal Ductwork
   18. Ductwork Accessories
   19. Duct Silencers
   20. HVAC Fans
   21. High-Volume Low-Speed Propeller Fans
   22. Dust Collection Systems

23. Series Fan Powered Terminal Units
24. Single Duct VAV Terminal Box
25. Parallel Fan Powered Terminal Unit
26. Dual Duct Air Terminal Units
27. Air Distribution Devices
28. HVAC Gravity Ventilators
29. Air Filters
30. Air Purification Systems
31. Flue Pipe Systems
32. Non-Condensing Boilers
33. Condensing Boilers
34. Finned Water-Tube Boilers
35. Steel Water-Tube Boilers
36. Gas Fired Furnaces
37. Gas Fired Roof Mounted Make-up Air Unit Heaters
38. Shell and Tube Heat Exchanger
39. Plate-Type, Liquid-To-Liquid Heat Exchangers
40. Centrifugal Liquid Chiller
41. Rotary Screw Water Chillers
42. Air Cooled Rotary Liquid Chiller
43. Induced Draft Cooling Tower
44. Energy Recovery Ventilator
45. Modular Indoor Central Station Air Handling Units
46. Packaged Air Handling Unit
47. Modular Outdoor Central Station Air Handling Units
48. 100% Outside Air Rooftop Unit with Gas Heat
49. Self-Contained Air Conditioners
50. Rooftop Heating and Cooling Units Electric Cooling-Gas Heating
51. Rooftop Heating and Cooling Units Electric Cooling-Electric Heat
52. Variable Air Volume Rooftop Units
53. Split System Air-Conditioners - Wall-Mounted
54. Variable Refrigerant Flow (VRF) for HVAC System
55. Water Source Heat Pump Unit
56. Fan Coil Unit
57. Unit Ventilators
58. Electric Unit Heaters
59. Electric Duct Heaters
60. Radiant Heating Electric Cables
61. Air Conditioning Unit for Swimming Pool Enclosures

I. Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.15 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
    1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
        a. Wall and type locations.

b. Clearances for installing and maintaining insulation.
c. Locations of light fixtures and sprinkler heads.
d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
e. Equipment connections and support details.
f. Exterior wall and foundation penetrations.
g. Routing of storm and sanitary sewer piping.
h. Fire-rated wall and floor penetrations.
i. Sizes and location of required concrete pads and bases.
j. Valve stem movement.
k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 23.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:
1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.

2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.17 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
    a. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
    b. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
    c. Servicing instructions and lubrication charts and schedules.

1.18 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.19 OPERATING AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 23. In addition to the requirements of other Sections, this shall include the following information for equipment items:
   1. Identifying names, name tags designations and locations for all equipment.
   2. Valve tag lists with valve number, type, color coding, location and function.
   3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
   4. Fabrication drawings.
   5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
   6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   8. Servicing instructions and lubrication charts and schedules.
   9. Equipment and motor name plate data.
   10. Wiring diagrams.
   11. Exploded parts views and parts lists for all equipment and devices.
   12. Color coding charts for all painted equipment and conduit.
   13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
   14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.20 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three (3) shifts of four (4) hours each.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.21 FINAL COMPLETION

A. At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.22 CONTRACTOR'S GUARANTEE

A. Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees provided by the equipment manufacturer for a period of not less than 5 years beyond the date of Substantial Completion.

E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.23 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be at the Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.
   1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
   2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surface: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install doors only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide 6-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.1 in this section and architect for access doors specifications and location.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.
14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

19. Provide construction filters for all air handling units, fan coil unit, VAV boxes, and all other air handling equipment during the entire construction period.
20. Provide temporary construction strains for all strainers in the hydronic systems during the initial flushing of the systems.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.
4. Start-up for major HVAC equipment such as chillers, cooling towers, variable frequency drives and hot water boilers shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to, the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment, etc., which is to remain but is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

END OF SECTION

SECTION 23 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 013100 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents, this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4” scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

H. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   1. Wall and type locations.
   2. Clearances for installing and maintaining insulation.
   3. Locations of light fixtures and sprinkler heads.
   4. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   5. Equipment connections and support details.
   6. Exterior wall and foundation penetrations.
   7. Routing of storm and sanitary sewer piping.
   8. Fire-rated wall and floor penetrations.
   9. Sizes and location of required concrete pads and bases.
   10. Valve stem movement.
   11. Structural floor, wall and roof opening sizes and details.

I. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

J. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

K. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

L. Sequence of Coordination - Below is hierarchy of model elements and the sequencing by which the models will be coordinated.
   1. Structural and Architectural model
   2. Miscellaneous steel
   3. Perform preliminary space allocation
   4. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
   5. Main and medium pressure ducts from the shaft out
   6. Main graded plumbing lines and vents
   7. Sprinkler mains and branches
   8. Cold and hot water mains and branches
   9. Lighting fixtures and plumbing fixtures
   10. Smaller sized ducts and flex ducts
   11. Smaller size cold water and hot water piping, flex ducts, etc.

M. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

N. The Contractor shall be responsible for coordination of all items that will affect the installation of the work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

O. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 23 03 00 - MECHANICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

B. The Drawings do not show all demolition work required. The Contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C. Utility service outages required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.2 RELATED SECTIONS

A. Section 02 40 00 - Demolition and Structure Moving.

1.3 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will cooperate with the Contractor; however, the following provisions must be observed:
   1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
   2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and Sub-subcontractors, and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

1.4 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment, etc., which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements, and piping arrangements are as shown on Drawings.

B. Verify that abandoned piping and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing Record Documents. Report discrepancies to Architect and Engineer before disturbing existing installation.

D. Beginning of demolition means that the contractor accepts existing conditions.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary connections, if required, to maintain existing systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.

D. Existing Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Division 02 and this Section.

B. Remove, relocate, and extend existing systems to accommodate new construction.

C. Remove abandoned piping to source of supply.

D. Remove exposed abandoned piping systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing systems which remain active. Modify installation or provide access doors as appropriate.

G. Extend existing systems using materials and methods compatible with existing systems, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 02.

3.6 REMOVAL OF MATERIALS

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operating condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

E. Certain work during the demolition and construction phases may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner's Representative at least 72 hours in advance in writing.

F. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.

G. See Paragraph I on page 23 02 00 – 18

H. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

I. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

J. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. WORK SPECIFIED ELSEWHERE:
   1. Painting
   2. Automatic temperature controls
   3. Power control wiring to motors and equipment

1.3 WARRANTY

A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion.

1.4 REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

B. NEMA MG 1 - Motors and Generators; 2021.

1.5 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.6 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.
   1. Baldor
   2. Marathon
   3. Siemens-Allis
   4. General Electric
   5. U.S. Motor

B. TEMPERATURE RATING: Provide insulation as follows:
   1. CLASS B: 40 degrees C maximum.
   2. CLASS F:
      a. Between 40 degrees C and 65 degrees C maximum.
      b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.
   1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
   2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
   3. Name plate voltage shall be the same as the circuit's nominal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greaseable ball bearings; with top mounted Zerk lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:
   1. Design for thrust where applicable.
   2. PERMANENTLY SEALED: Where not accessible for greasing.
   3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows, except where otherwise indicated:
   1. CONCEALED INDOOR: ODP (Open Drip Proof).
   2. EXPOSED INDOOR: Guard Protected.
   3. OUTDOOR TYPICAL: Type II. TEFC.
   4. OUTDOOR WEATHER PROTECTED: Type I. WPI.
   5. EXPLOSION PROOF, XP: For use in hazardous locations.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. All motors that are to be operated by a variable frequency drive shall be inverter duty rated motors.

L. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

M. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE 112, Method B, including stray load loss measure.

NEMA MG 1 Efficiency - 1800 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	95.0
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8

NEMA MG 1 Efficiency - 1200 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 23 and installed under Division 26 unless otherwise noted on the plans.
   1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B. Motor starters shall be furnished as follows.
   1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
   2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
   3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
   4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
   5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
   6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
   7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers.
11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.3 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.02-B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 26 28 16.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D. Install rotating equipment in static and dynamic balance.

E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Flexible pipe connections.

B. Expansion joints and compensators

C. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

A. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

B. Section 23 21 13 - Above Ground Hydronic Piping

C. Section 23 22 13 - Steam and Condensate Heating Piping

D. Section 23 23 00 - REFRIGERANT PIPING

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:
1. Installation Temperature: 50 degrees F (10 degrees C)
2. Hot Water Heating: 210 degrees F (99 degrees C)
3. Domestic Hot Water: 140 degrees F (60 degrees C)
4. Steam: 380 degrees F (193 degrees C)
5. Steam Condensate: 212 degrees F (100 degrees C)
6. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer’s literature for model series for different pipe sizes.

1.5 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer`s Installation Instructions: Indicate special procedures, and external controls.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping (Based on 2" Pipe):
   1. Manufacturers:
      a. VMC Group, Model SS-PM or SS-FP
      b. Mercer Rubber Company, Model BSS-EM (Mason Industries)
   2. Inner Hose: Type 321, stainless steel, corrugated metal.
   3. Exterior Sleeve: Type 304, single braided stainless steel.
   4. Pressure Rating: 350 psig WOG and 70 degrees F. For 4 inch pipe - 200 psig WOG and 70 degrees F.
   5. Joint: Schedule 40 steel, threaded with male nipple and hex boss each end and union. Flanged joints for pipe sizes 2½ inch and larger.
   6. Size: Use pipe sized units.
   7. Maximum offset: 1/2 inch on each side of installed center line.

8. Application: Air handling unit cooling and heating coils.

B. Copper Piping (Based on 2" Pipe):
1. Manufacturers:
   a. VMC Group, Model BR-FS
   b. Mercer Rubber Company, Model BFF (Mason Industries)
2. Inner Hose: Corrugated Bronze
3. Exterior Sleeve: Braided bronze.
4. Pressure Rating: 250 psig WOG and 70 degrees F.
5. Joint: Threaded with male nipple and hex boss each end with union. Flanged joints for pipe sizes 2½ inch and larger.
6. Size: Use pipe sized units.
7. Maximum offset: 1/2 inch on each side of installed center line.
8. Application: Air handling unit cooling and heating coils.

2.2 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):
1. Manufacturers:
   a. VMC Group, Model EB
   b. Mercer Rubber Company, Model 803 or 805 (Mason Industries)
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

2.3 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:
1. Manufacturers:
   a. Metraflex, Style IV
2. Two piece welded steel with shop paint, and bolted to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer`s instructions.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provided line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

3.2 MANUFACTURER`S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by flexible pipe manufacturer`s representative for final installing and certify installation is in accordance with manufacturer`s recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 23 05 26 - VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Section 1.01 A in Section 23 05 13

B. Section 1.01 B in Section 23 05 13

C. Furnish and install a complete adjustable frequency motor speed control for the following items:
   1. Variable volume air handling units.
   2. Chilled water pumps
   3. Condenser water pumps
   4. Hot water pumps
   5. Cooling tower fans.
   6. Variable volume ventilation fans.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 21 23 - HYDRONIC PUMPS

G. Section 23 73 13 - Modular Indoor Central Station Air Handling Units

1.3 REFERENCES

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ISO 9001 - Quality Management Systems — Requirements; 2015.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

E. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Certified noise data shall be submitted by drive manufacturer. Noise generated by variable frequency motor speed control drive shall not exceed preferred “RC” as listed in 2019 ASHRAE (HVACA), Chapter 49 Noise and Vibration Control, Table 2 Criteria for Acceptable HVAC Noise in Unoccupied Rooms.

C. Submit variable frequency drives after motor size coordination with the approved associated equipment.

1.5 WARRANTY

A. Warranty shall be 24 months and shall begin from the date of Certificate of Substantial Completion. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll-free phone number.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be stored and handled per manufacturer's instructions.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ABB

B. Danfoss

2.2 ADJUSTABLE FREQUENCY INVERTER

A. The AFD package as specified herein shall be enclosed in a NEMA 12 enclosure for interior applications, a NEMA 3R enclosure for exterior locations and a NEMA 4X enclosure where located in a cooling tower yard or within 20 feet from cooling tower. All enclosures shall be completely assembled and tested by the manufacturer in an ISO 9001 facility. The AFD shall operate from a line of +30% over nominal and the under-voltage trip level shall be 35% under the nominal voltage as a minimum.

B. The fused input shall utilize fast acting current limiting type per manufacturer recommendations.

C. The variable frequency power and logic unit shall be completely solid state. The unit shall transform 480 Volt or 208 Volt (as indicated on plans), 3 phase, 60 hertz input power into frequency and voltage controlled, 3 phase output power suitable to provide positive speed and torque control to the fan motor. The speed control shall be step-less throughout the speed range under variable torque load on a continuous basis. The adjustable frequency control shall be of a pulse width modulated type utilizing a full wave diode bridge rectifier; and shall have a power factor of 0.95 or better at all motor loads.

D. All AFD's shall have the same customer interface, including a backlit LCD two-line digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for the start-up of multiple AFD's. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference.

E. The adjustable frequency inverter shall conduct no radio frequency interference (RFI) back to the input power line.

F. The AFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection from AC line transients. The inverter/reactor shall be a single wiring point.

2.3 SELF PROTECTION

A. The following features for self-protection shall be included:
   1. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NFPA 70 - Table 430-150 for 4-pole motors.
   2. Limit the output current in under 50 microseconds due to phase to phase short circuits or severe overload conditions.
   3. Protect the inverter due to non-momentary power or phase loss. The undervoltage trip shall activate automatically when the line voltage drops 15% below rated input voltage.
   4. Protect the inverter due to voltage levels in excess of its rating. The overvoltage trip shall activate automatically when the DC bus in the controller exceeds 1000 VDC.
   5. Protect the inverter from elevated temperatures in excess of its rating. An indicating light that begins flashing within 10 degrees C of the trip shall be provided to alert the operator to the increasing temperature condition. When the over temperature trip point is reached, this light shall be continuously illuminated.
   6. The inverter shall be equipped such that a trip condition resulting from overcurrent, undervoltage, overvoltage or overtemperature shall be automatically reset, and the inverter shall be automatically reset, and the inverter shall automatically restart upon removal, or correction of the faulty condition.
   7. Status lights for indication of conditions described above shall be provided. A SPDT contact for remote indication shall be provided. Additionally, status lights to show power on, zero speed, and drive enabled shall be provided. All status lights shall be self-contained in the front panel of the unit and shall be duplicated for ease of troubleshooting on the inside of the unit.
   8. Current and voltage signals shall be isolated from logic circuitry.
   9. Drive logic shall be microprocessor based.
   10. In the event of a sustained power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation if the start is in the "On" condition.
   11. In the event of a momentary power loss, the control shall be shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation (if the start is in the "On" position) being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
   12. In the event of a phase to phase short circuit, the control shall shut down safely without component failure.
   13. In the event that an input power contactor is opened or closed while the control is activated, no damage shall result.

14. To facilitate startup and troubleshooting, the control shall operate without a motor or any other equipment connected to the inverter output.

2.4 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual full bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the “bypass” mode. Fast-acting semi-conductor with a fuse block shall be provided to isolate the drive for service. Bypass designs that have no such fuses must have a lockable disconnect that isolates the drive while running in bypass mode. The Contractor device shall be NEC approved. A common start/stop signal shall be used for both the variable frequency drive mode and bypass mode. Manual bypass shall contain the following:
   1. Two contactors mechanically interlocked via a three position through the door selector switch or keypad to provide the following controls:
      a. “Inverter” mode connects the motor to the output of the inverter.
      b. “Bypass” mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via electronic overload.
      c. “Off” mode disconnects motor from all input power.
      d. A molded case circuit breaker with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
      e. Customer Interlock Terminal Strip - provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is Hand, Auto, or Bypass mode. The remote start/stop contact shall operate in AFD and bypass modes.
      f. An electronic overload selectable for class 20 or 30 shall provide protection of the motor in Bypass mode.
   2. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
      a. Power on
      b. External fault
      c. Drive mode selected
      d. Bypass mode selected
      e. Drive running
      f. Bypass running
      g. Drive fault
      h. Bypass fault
      i. Bypass-H-O-A mode
      j. Automatic transfer to bypass selected
   3. The following relay (form C) outputs from the bypass shall be provided:
      a. System started
      b. System running
      c. Bypass override enabled
      d. Drive fault
      e. Bypass fault (motor overload or underload (broken belt))

f. Bypass H-O-A position

4. The AFD shall include a “run permissive circuit” that will provide a normally open contact any time a run command is provided (local or remote start command in AFD or bypass mode). The AFD system (AFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch). When the AFD systems safety interlock (fire detector, freezestat, high static pressure switch, etc.) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
5. There shall be an internal switch to select manual or automatic bypass.
6. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication when in the bypass mode.
7. The bypass mode must include an undervoltage and phase loss relay to protect the motor from single phase power and undervoltage conditions.
   a. Bypass shall be UL listed.
   b. Bypass shall carry a UL 508 label.

2.5 FEATURES AND SPECIFICATIONS

A. Provide all drives and bypasses with an integral disconnect switch. The disconnect shall be door interlocked and lockable. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and include a UL 508A label.

B. Output frequency shall neither vary with load nor with any input frequency variations. Output frequency shall not vary within +/-10% input voltage changes. Output frequency shall not vary with temperature changes within the ambient specification.

C. No auxiliary equipment shall be required. The output frequency shall be adjusted in proportion to 4-20 mA signal.

D. A 0 to 10 Volt DC signal shall be provided for remote indication. This 0 to 10 Volt DC signal shall vary in direct proportion to the controller speed.

E. The controller shall be started or stopped by a contact closure or through serial communications.

F. A single pole, double throw contact shall be provided for remote indication. Contact will change state when any trip condition has occurred. (contact rated for 12-250 VAC-2 AMPS).

G. A second single pole, double throw contact shall be provided for remote indication. Contact will state when the VFD receives a run command (contact rated for 12-250 VAC-24 AMPS).

H. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.

I. Unit to operate from a 4 to 20 mA input signal and shall have hand-off-auto switch and door mounted potentiometer controls for manual speed selection.

J. Acceleration and deceleration times shall be adjustable from 30 to 300 seconds.

K. The drive shall have the ability to invert the speed signal input, as well as having offset and gain controls for speed signal conditioning.

L. Minimum and maximum speeds shall be adjustable in automatic and manual modes.

M. Hazard inputs shall be provided, capable of up to two inputs (fire, freeze). These shall each be capable of safely shutting down the inverter and illuminating a front panel hazard light depicting that a hazard condition turned the inverter off.

N. The inverter shall be a starter, containing a door interlocked input disconnect switch and manual reset motor electronic overloads, with accessible reset on front door, when a bypass is not specified.

O. Solid state ground fault interrupt circuit.

P. The LED display shall monitor and display four parameters on a single display (i.e. frequency command, output frequency, output current, and torque).

Q. A N.O. auxiliary run-time contact shall be provided for control signaling to auxiliary equipment. Contact shall close when the pump is brought on line and open when the pump is taken off line. Contact shall be rated 20 amps at 120 volts.

R. The drive shall be UL listed as a complete assembly. The drive assembly shall have a minimum short circuit current rating of 65,000 AIC when installed in accordance with the manufacturer's guidelines.

S. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, and a copy kept on file at the manufacturer

T. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

U. A computer based training CD or 8-hour professionally generated video in digital file format shall be provided to the Owner at the time of Substantial Completion. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

V. Provide a motor end surge control voltage suppressive filter if the VFD manufacturer cannot limit their voltage surges to under 1000 volt at 100 feet.

W. Provide a motor acoustic noise reduction filter capable of approximately 12 dBA attenuation, if the VFD raises the dBa level above 3 dBa at a distance of 3 feet from the motor.

X. Provide each unit with a 3% reactor which is mounted on both the positive and negative DC bus. The reactor shall be a single wiring point and mounted internally to the drive.

Y. Adjustable frequency inverters shall have native BACnet protocol for integration with EMCS. If the inverter does not have native BACnet protocol, a BACnet interface card shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install drives in accordance with manufacturer's published installation instructions. Installation location shall provide all required clearances around each drive.

B. All wiring shall be installed in accordance with the manufacturer's installation instructions.

C. Variable frequency speed drives shall be located so that wiring to the associated motor does not exceed 100 feet.

D. Separate metal conduits shall be provided for each of the following. None of these wiring categories shall be run within the same conduit.
   1. Line side, input power wiring
   2. Load side, motor power wiring
   3. Control or communication wiring
   4. Fire alarm system wiring

3.2 START-UP

A. Start-up services shall be provided for each unit by a factory authorized service provider.
   1. Complete installation inspection and start-up checks according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

A. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

B. Section 23 07 16 - HVAC EQUIPMENT INSULATION

C. Section 23 07 19 - HVAC Piping Insulation

D. Section 23 21 13 - Above Ground Hydronic Piping

E. Section 23 21 16 - Underground Hydronic Piping

1.4 REFERENCES

A. ASME B31.1 - Power Piping; 2024.

B. ASME B31.9 - Building Services Piping; 2020.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.5 QUALITY ASSURANCE

A. Hangers and Supports for HVAC Piping: In conformance with ASME B31.1 and ASME B31.9.

B. Hangers and Supports for HVAC Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

C. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipes Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipes Sizes 2 to 4 Inch: Carbon steel, adjustable clevis.

C. Hangers for Pipes Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roller, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers, pre-formed manufactured saddles and hanger rods; cast iron roller and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roller and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
   1. For pipes 2-1/2” and smaller - Type PP10 with roller
   2. For pipes 3” through 8” - Type PS
   3. For multiple pipes - Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. Shields for Vertical Copper Pipe Risers: Sheet lead.

M. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/Architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

B. For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with Architectural Drawings and details.

2.6 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Beams, Interior Walls, Exterior Walls, Footings, and Potentially Wet Floors: Form with steel pipe, Schedule 40, galvanized.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed, manufactured by Hilti.

D. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

E. Caulk: Paintable 25-year acrylic sealant.

F. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 MECHANICAL SLEEVE SEALS

A. Modular sealing element unit, designed for field assembly, to continuously fill annular space between pipe and sleeve and create watertight seal.
   1. Approved Manufacturers:
      a. Link-Seal by Garlock Pipeline Technologies (GPT)
      b. Innerlynx by Advance Products & Systems, Inc.
      c. MetraSeal by Metraflex Co.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material, size of pipe, and service requirements.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.9 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with Structural Engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with Structural Engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow, and at the vertical to horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor.

G. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners, hardware, braces, unistrut, structural steel members, and appurtenances required to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

K. Portable pipe hanger systems shall be installed per manufacturer's instructions.

L. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.3 INSULATED PIPING

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C. Shields: Install protective shields MSS SP-58 Type 40 on cold and chilled water piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Shield Length	GaugeThickness
1/4 through 3-1/2 inch	12	18
4 inch	12	16
5 through 6 inch	18	16
8 through 14 inch	24	14
16 through 24 inch	24	12

E. Piping 2" and larger: provide galvanized sheet metal shields with calcium silicate insulation at hangers/supports.

F. Insert material shall be at least as long as the protective shield.

G. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

D. Construct support of steel members. Brace and fasten with flanges bolted to structure.

E. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations that extend minimum 8 inches above adjacent roofing surface. Contact Architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Sleeves shall be provided at the following locations:
   1. Piping passing through rated and non-rated floor assemblies, rated ceiling assemblies, and roof assemblies.
   2. Piping passing through concrete, masonry, and rated gypsum board walls and partitions.
   3. Piping passing through exterior wall assemblies above and below grade.
   4. Piping passing through non-rated gypsum board walls and partitions where indicated on the drawings or where exposed to view.
   5. Piping passing through structural members where indicated on the drawings or where exposed to view.
   6. Any other locations indicated on the drawings.

B. Set sleeves in position in formwork. Provide reinforcing around sleeves.

C. Extend sleeves through floors minimum one inch above finished floor level. Sleeves located in walls, ceilings, and structural members shall be flush with the outer surfaces of the assembly being penetrated.

D. Where sleeved piping penetrates a floor, ceiling, or interior wall assembly, pack annular space between pipe and sleeve with UL listed fire stopping insulation and caulk seal airtight with fire barrier sealant. Provide close fitting metal collar or escutcheon covers at both sides of wall penetrations and exposed side of ceiling penetrations.

E. Install all UL listed, prefabricated fire rated steel sleeves per the manufacturer’s installation instructions to ensure fire rating is maintained.

F. Sleeves at exterior walls below grade shall be sealed with mechanical sleeve seal. Install seal per manufacturer’s installation instructions. Select type and number of sealing elements required for pipe material, pipe size, and service requirements. Position pipe in center of sleeve. Assemble mechanical sleeve seal and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal. Locations above grade shall be provided with close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Vibration and sound control products.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C. Unless otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. VMC Group

B. Mason Industries, Inc.

C. Kinetics Noise Control, Inc.

D. Vibration Eliminator Co., Inc.

2.2 GENERAL

A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B. Model numbers of VMC Group products are included for identification. Products of the listed manufacturers will be acceptable provided they comply with all the requirements of this specification.

2.3 FLOOR MOUNTED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model CAL-2 aluminum housed isolators sized for 2” static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.

B. If floor mounted air handling units are furnished with internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for condensate drains. Ribbed elastomeric pads shall be located in accordance with the air handling unit manufacturer’s recommendations.

2.4 SUSPENDED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model HRS-2 combination spring and elastomeric isolation hanger sized for 2’’ static deflection.

B. If suspended air handling units are furnished with internal vibration isolation option, provide VMC Group model HR elastomeric isolation hangers sized for approximately ½’’ deflection to address high frequency break-out.

2.5 SUSPENDED FANS AND FAN COIL UNITS

A. Provide VMC Group model HS spring hangers sized for 1’’ static deflection.

2.6 BASE MOUNTED PUMPS

A. Provide VMC Group model SP-NR, style E, elastomeric isolation pads consisting of two layers of 3/8’’ thick alternate ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate.

B. Pads shall be sized for approximately 40 psi loading and 1/8’’ deflection.

C. Provide VMC Group model CPF, 8” concrete inertia base. Base shall be welded steel construction with concrete in-fill supplied by the contractor on site and shall incorporate standard rebar reinforcement, spaced a maximum of 12” on center. Provide VMC Group model AWH, floor mounted spring isolators sized for 1 inch static deflection.

D. Provide inertia bases for all base mounted pump applications in which the pumps are to be installed on any floor level other than the ground floor or grade level. Inertia bases shall also be provided for base mounted pump applications in which the associated mechanical room where they are housed is in a noise sensitive location, regardless of floor level.

2.7 BASE MOUNTED CHILLERS

A. Provide VMC Group model SP-NR, style E, elastomeric isolation pads consisting of two layers of 3/8’’ thick alternate ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate.

B. Pads shall be sized for approximately 40 psi loading and 1/8’’ deflection.

2.8 ROOF MOUNTED CHILLERS

A. Provide VMC Group series M steel housed spring isolators with vertical uplift restraints sized for 2” static deflection.

B. Isolators to have weatherproof construction with cadmium plated springs, hot-dip galvanized housings, and zinc-electroplated hardware. Removable spring packages to include 1/4" ribbed elastomeric pad under baseplate(s).

C. Any structural steel supports provided between the top of the isolators and bottom of chiller shall be coordinated with the structural engineer.

2.9 ROOF MOUNTED COOLING TOWERS

A. Provide VMC Group series M steel housed spring isolators with vertical uplift restraints sized for 3” static deflection.

B. Isolators to have weatherproof construction with cadmium plated springs, hot-dip galvanized housings, and zinc-electroplated hardware. Removable spring packages to include 1/4" ribbed elastomeric pad under baseplate(s).

C. Steel beams between the top of the isolators and bottom of cooling tower cells shall be provided and coordinated with the structural engineer.

2.10 CONDENSING UNITS

A. Provide VMC Group model NRC, 1" thick ribbed elastomeric isolation pads sized for approximately 40 psi loading and 1/8’’ deflection.

B. Pads shall be located in accordance with the condensing unit manufacturer’s recommendations.

2.11 PIPING

A. Provide VMC Group model HRS combination spring and elastomeric isolation hangers in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2’’ diameter and larger. Isolators shall be sized for the same deflection as the isolators specified for the equipment up to a maximum of 2" deflection for at least the first three piping hangers; the remaining hangers shall have isolators sized for 1" deflection.

B. Floor supported piping is required to be isolated with VMC Group model AW-1 open springs sized for 1’’ deflection.

C. All condenser water piping shall be supported with VMC Group model AW-1 open springs sized for 1” deflection for floor or roof mounted piping and VMC Group model HRS-1 combination spring and elastomeric isolation hangers sized for 1” deflection for suspended piping.

D. Provide line size flexible connectors at supply and return of pumps, chillers, and all other locations indicated on the mechanical drawings and details. Flexible pipe connectors shall be VMC Group model 2800 single sphere EPDM construction and shall include 150 lb. cadmium plated carbon steel floating flanges.

2.12 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphate coated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

D. The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Refer to Architectural Sections for additional requirements.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:
1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.
5. Provide wall mounted laminated floor plans in central plant showing valve locations for the entire floor. Provide separate laminated sheets for each floor of the building.

B. Pipe Marking:
1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.
3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.

4. Provide pipe markers that meet labeling requirements of ASME A13.1 for all refrigerant piping located in areas other than the room or space where the associated equipment is located. Pipe markers shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: “DANGER – Risk of Fire or Explosion. Flammable Refrigerant.” For any Group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant”.
5. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.
6. Markers shall be colored as indicated below per ASME A13.1.

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply; Chilled Water Return
Hot Water	Reddish Orange	Hot Water Supply; Hot Water Return
Condenser Water	Green	Condenser Water Supply; Condenser Water Return
Compressed Air	Blue	Compressed Air
Pneumatic Control	Yellow	Pneumatic Controls
Oxygen	Yellow	Oxygen
Nitrogen	Green	Nitrogen
Deionized Water	Green	Deionized Water
Steam	Yellow	Steam Supply; Steam Return

C. Pipe Painting:
1. All exposed piping interior and exterior shall be painted. Interior color shall be according to the adopted color code chart and shall be appropriately labeled at intervals in specified height letters. Piping exposed to view shall be painted to comply to color scheme or as directed by the Architect in the field. Piping on roof/exterior shall be painted with epoxy or polyurethane industrial coating. Confirm all color selections with Architect prior to installation.
2. Piping in central plant mechanical yard shall be epoxy painted or polyurethane industrial coating applied in the appropriate color below. Insulated pipe will have the insulation jacket painted and non-insulated pipe shall be properly prepared and painted.
3. Provide a framed copy of the chart below in the central plant for maintenance personnel reference.

SYSTEM	COLOR
Chilled Water from Chiller	Dark Blue (SW-4056)
Chilled Water to Chiller	Light Blue (SW-4054)
Hot Water from Boiler	Dark Red (SW-6871)
Hot Water to Boiler	Light Red (SW-6858)
Condenser Water from Tower	Light Green (SW-4069)
Condenser Water to Tower	Dark Green (SW-4071)
Natural Gas Piping	Safety Yellow (SW-4084)

2.2 EQUIPMENT IDENTIFICATION

A. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal with minimum 1/2 inch high letters manufactured by Seton Company or approved equal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All labeling equipment shall be installed as per manufacturer’s printed installation instructions.

B. Provide engraved laminated plastic labels on ceiling grids and access doors at all locations that provide access to mechanical equipment, valves, motorized dampers, and accessories located above ceiling. The labels shall be white background with black text with 1/4 inch high letters and shall identify the component that is accessible at that location. Valves shall be identified with labels engraved "VL".

C. Provide engraved laminted plastic labels on ceiling grids and access doors at all locations that provide access to fire dampers, smoke dampers, and combination fire/smoke dampers located above ceiling. The labels shall be white background with red text with 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, or FIRE DAMPER to identify the damper type that is accessible at that location.

D. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer’s requirements.

E. All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect’s required paint system(s).

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 RELATED DOCUMENTS

A. Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.01 of this Section, will be provided by the Contractor.

1.3 DESCRIPTION

A. The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by the Owner whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.4 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:
   1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
   2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.
   3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SERVICES OF THE CONTRACTOR

A. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F. Provide personnel to correct, repair, make adjustments to, or replace deficient items or conditions found during the testing, adjusting, and balancing period, including but not limited to sheave changes. The Contractor shall also be responsible for addressing applicable items included on the TAB Contractor's deficiency log.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project construction schedules shall provide time to permit the successful completion of TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:
   1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.
   2. AIR DISTRIBUTION SYSTEMS:
      a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
      b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
      c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.
      d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.

e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.

f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.

3. WATER CIRCULATING SYSTEMS:

a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.

b. For retrofit projects, record each existing pump motor amperage and voltage. Readings shall not exceed nameplate rating.

c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.

d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Engineer of deficiencies.

e. Check and set operating temperatures of heat exchangers to design requirements.

f. The various existing water circulating systems, including existing strainers, shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.

4. AUTOMATIC CONTROLS:

a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.

b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.

c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I. Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.2 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F. Contractor shall utilize ultrasonic flow meter to balance water flow of existing water system if the original pressure drop data is not available. Contractor shall remove insulation as necessary to use flow meter.

G. Participate in the commissioning process, which shall include but not be limited to attending commissioning meetings, coordinating work with and completing checklists as required by the commissioning team.

H. The TAB firm shall furnish electronic copies of the testing, adjusting, and balancing reports and shop drawings to the Owner.

I. The TAB firm shall include the Owner on all reports and deficiency logs submitted to the design and construction teams throughout construction, just the final copy.

3.3 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Owner and Engineer the following data to be approved by the Owner and Engineer:
   1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
   2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
   3. Air quantities at each return and exhaust air handling device.
   4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.
   5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
   6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
   7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.4 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:
   1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.

2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
    a. Tabulation of air volume at each outlet.
    b. Outside dry bulb and wet bulb temperature.
    c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
    d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:
1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (±2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:
1. Test apparatus
    a. The test apparatus shall consist of:
    b. A source of high pressure air - a portable rotary blower or a tank type vacuum cleaner.
    c. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.
2. Test Procedures
    a. Test for audible leaks as follows:
        1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
        2) Start the blower with its control damper closed.
        3) Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
        4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
    b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
        1) Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
        2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.

3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D. DX SYSTEMS:
1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F. The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Ductwork system insulation.

1.3 RELATED SECTIONS

A. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 31 13 - Metal Ductwork

1.4 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

D. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NAIMA FGDLS - North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards; Current Edition, Including All Revisions.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

J. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.
   1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D. Adhesive and other material shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

E. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

F. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

1.6 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.7 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

2.2 ACCEPTABLE MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by 3M Company, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Ceramic fiber materials shall be as manufactured by Primer Refractories, A.P. Green Refractories or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install duct insulation and all associated accessories in accordance with the manufacturer’s published instructions and industry standard practices detailed by NAIMA FGDLS and SMACNA (DCS).

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.2 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3-inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic. Vapor barrier mastic shall be Childers CP-33 or approved equal for ductwork located indoors and shall be Childers CP-35 or approved equal for ductwork located outdoors.

C. All external duct insulation shall be Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite duct wrap insulation with FSK facing or approved equal.

D. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space that conveys air from conditioned spaces or vice versa shall also be provided with external duct wrap. Duct wrap shall be provided as follows:

1. 1½” thick, 1.0 pcf density minimum; minimum installed R-value of 4.5 when ducts are located in directly conditioned spaces.
2. 2” thick, 1.0 pcf density minimum; minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air or located indoors concealed within chases or shafts.
3. 3" thick, 0.75 pcf density minimum; minimum installed R-value of 8.3 when ducts are located in unconditioned spaces.

E. Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

3.3 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct required to be insulated by any section of this specification that is routed exposed in occupied spaces shall be double wall.

B. Duct routed exposed shall be double wall with perforated inner liner and glass mineral wool insulation. Provide 1” thick insulation when ductwork is located in conditioned spaces and 2” thick in unconditioned spaces, insulation density shall be a minimum of 1.0 PCF. Double wall duct shall be United McGill model Acousti-k27 for round or oval ducts and Rectangular-k27 for rectangular ducts or approved equal.

3.4 EXPOSED DUCT LOCATED OUTDOORS

A. All metal ductwork located outdoors shall be internally lined with fiberglass Duct Liner as specified and externally insulated with 2" thick, 6.0 pcf density fiberglass Insulation Board with FSK facing. The protective finish system shall be 0.016” minimum thickness aluminum jacketing.

B. Paint non-insulated duct. Coordinate color with Architect.

3.5 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed external duct wrap matching the thickness, density, and R-value of the associated duct system.

B. The contractor shall install an additional layer of 1-½ inch thick external glass mineral wool duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and vapor-sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

3.6 KITCHEN GREASE HOOD EXHAUST DUCT

A. All type I kitchen range hood exhaust duct shall be enclosed with 2-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant per ASTM E1966. Sealant shall be 3M CP 25WB+ or 303 fire barrier caulk and putty.

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use two layers of 2-hour fire rated duct wrap such as 3M Fire Barrier Duct Wrap 615+ or Unifrax FyreWrap Elite 1.5 in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:
   1. Duct wrap system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 2 hours.
   2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
   3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.
   4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

3.7 DRYER VENT DUCT

A. All dryer vent duct routed within an air plenum shall be enclosed within a 1-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant per ASTM E1966. Sealant shall be 3M CP 25WB+ or 303 fire barrier caulk and putty.

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use a single layer of 1-hour fire rated duct wrap such as 3M Fire Barrier Duct Wrap 615+ or Unifrax FyreWrap Elite 1.5 in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:
   1. Duct wrap system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 1 hour.
   2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
   3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.
   4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

END OF SECTION

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Work specified elsewhere.
   1. Basic materials and methods.
   2. Piping systems.
   3. Air distribution equipment.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

C. All HVAC equipment insulation shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

D. Adhesives and other materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

C. A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

F. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

3.2 CHILLED WATER PUMPS

A. Shall be insulated with Knauf Insulation Board with ECOSE Technology, Certain-Teed IB-600 or equal, rigid insulation board, 2" thick, cut and formed into a box and secured in place with 3/4" wide x 0.020 galvanized bands spaced on 9" centers. Bands shall be pulled snug over sheets of insulation board. All joints shall be well and neatly fitted and so arranged that the assembly may be dismantled with ease permitting access to the pump. All voids on the interior of box shall be filled with glass mineral wool blanket insulation. Exterior shall be finished with a trowel coat of Foster's 30-35 vapor barrier mastic, a layer of 1" mesh galvanized wire, and a coat of Johns Manville CALCOAT-127 finishing cement. Final finish shall be an eight ounce canvas jacket, pasted and sealed in place with Foster's 30-36 Seafas.

B. Insulation Board shall comply with ASTM C612 and ASTM C553. The associated FSK facing shall comply with ASTM C1136.

C. Pipe insulation shall be extended over all cold parts of chilled water pumps not directly over drainage basin of pump base.

3.3 BOILER EXHAUST SYSTEM

A. Insulate boiler stack, breaching and induced draft fan housing in contact with flue gases, with 1-inch thick high temperature, spun glass mineral wool semi-rigid board. Knauf Insulation Elevated Temperature Board with ECOSE Technology, Johns-Manville 1000 Spin-Glass or approved equal, secured between outer facing of 1-inch galvanized wire mesh. Calcium silicate insulation, Johns-Manville Thermo-12 Gold or approved equal, may be applied at the contractor's option followed by application of 1-inch galvanized wire mesh.

B. In exposed areas, apply 1 1/4-inch coat of insulating and finishing cement, Ryder "V" One Coat or approved equal, troweled to a smooth surface. After cement has dried, surfaces shall be weatherproofed using 2 coats of mastic, Childers CP-10, with a layer of white glass cloth reinforcing embedded between coats.

C. Insulation Board for elevated temperature applications shall comply with ASTM C612.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Furnish and install piping insulation to:
   1. Chilled water and heating hot water piping.
   2. Condensate drain piping.
   3. Refrigerant piping.
   4. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.
   1. Painting.
   2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment

B. Section 23 21 13 - Above Ground Hydronic Piping

1.4 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C272/C272M - Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions; 2018.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

D. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

E. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

F. ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics; 2021.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

I. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

L. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 HVAC PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E. All HVAC piping insulation thicknesses shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Flexible elastomeric cellular thermal insulation by Armacell.

E. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

F. Polyisocyanurate foam insulation shall be as manufactured by Johns Manville.

G. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.3 MATERIALS

A. INTERIOR CHILLED WATER PIPING: Provide phenolic foam in accordance with ASTM C1126 with ASJ jacket and all joints sealed.

B. EXTERIOR CHILLED WATER PIPING: Provide molded closed cell polyisocyanurate insulation with ASJ jackeet and all joints sealed; ASTM D6226, 90% closed cell content; ASTM E96/E96M, maximum water vapor permeability rating of 4 Perm-In; ASTM C518, k-factor of 0.19 at 75°F; ASTM C272/C272M, water absorption value of less than 0.7% by volume after 24-hour immersion.

C. HEATING HOT WATER PIPING: Provide glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket or phenolic foam in accordance with ASTM C1126 with ASJ and all joints sealed.

D. CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultima", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

E. REFRIGERANT PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M. Provide model "Armaflex Ultima", fire rated for use in environmental air plenums for all indoor applications. Provide model "AP Armaflex", for all outdoor applications. Apply manufacturers recommended finish and sealant for outdoor applications.

F. METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

G. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed; complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

C. All heat recovery piping between air conditioning equipment and hydronic or domestic hot water piping shall be insulated per the High Temperature Surfaces Schedule below.

D. All condenser water piping located in a ceiling plenum shall be insulated per the requirements for indoor chilled water piping as indicated in the Low Temperature Surfaces Schedule below.

E. All water piping and refrigerant piping located outdoors or in tunnels shall be insulated same as concealed piping and shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

F. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

G. Provide all HVAC piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.
   1. Minimum Insulation Thickness for Low Temperature Surfaces
      a. Condensate drain lines: 1 inch
      b. Chilled Water Piping:

1) Located outdoors: 2 inch
2) Located indoors:
   a) 4 inch and smaller: 1-½ inch
   b) Larger than 4 inch: 2 inch

c. Refrigerant Piping
1) 1½“ and smaller: 1 inch
2) Larger than 1½ inch: 1-½ inch

2. Minimum Insulation Thickness for High Temperature Surfaces

a. Hot Water Piping:
1) Operating temperature 105°F or less: 1 inch
2) Operating temperature higher than 105°F and pipe size 1-¼ inch or smaller: 1-½ inch
3) Operating temperature higher than 105°F and pipe size greater than 1-¼ inch: 2 inch

b. Steam Piping:
1) Pipe size 1-½ inch and smaller: 2-½ inch
2) Pipe size more than 1-½ inch: 3 inch

c. Refrigerant Piping
1) 1-½ inch and smaller: 1-½ inch
2) Larger than 1-½ inch: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass mineral wool covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the joint is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder mastic shall be applied to all edges of the vapor retarder jacket.

3.3 STANDBY-GENERATOR ENGINE EXHAUST PIPING

A. Entire engine exhaust pipe from exhaust manifold to outside terminal shall be enclosed in a 1" thick layer of calcium silicate insulation.

B. A second insulating layer of 1" thick calcium silicate shall cover the first layer.

C. Joints for the first and second layer shall be staggered.

D. Apply aluminum jacket over outer layer of insulation.

E. Insulate exhaust muffler in the same manner as the exhaust piping.

3.4 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 23 08 00 - COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS:

A. Section 019100

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the HVAC system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
   2. CBCP - Certified Building Commissioning Professional - AEE
   3. CCP - Certified Commissioning Professional - BCA
   4. CPMP - Certified Process Management Professional - ASHRAE
   5. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide Testing and Balancing Report before Functional Testing begins.
   7. Provide As-built drawings and documentation to facilitate Testing.
   8. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   9. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   10. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   11. Provide data concerning performance, installation, and start-up of systems.
   12. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

13. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
14. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
15. Provide qualified personnel to assist and participate in Commissioning.
16. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
17. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Test Engineer in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
18. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
19. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
20. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
21. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
22. Coordinate and provide training of Owner's personnel.
23. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.
24. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
    1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
    2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.
    3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.

4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.
6. Air and hydronic system balancing: Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the contract documents. System balancing shall be performed by TAB contractor as specified in 23 05 93 - Testing, Adjusting, And Balancing.
7. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
8. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Equipment to be tested
   1. Energy Management and Control System:
      a. Graphical User Interface
      b. Automation Software
      c. Field Level Controllers
      d. Field Level Devices
      e. Control Sequences
   2. Chilled Water Systems (All chillers and pumps)
   3. Condenser Water Systems (All towers and pumps)
   4. Heating Water Systems (All boilers and pumps)
   5. Air Handling Systems (All AHU and 10% of terminal units)
   6. Energy Recovery Systems (100%)
   7. Water Treatment Systems (Verify vendors completion of scope)
   8. Service water heating systems (100%)

C. Testing functions and conditions
   1. Energy conservation programs (economizer, optimal start, etc)
   2. Verify shutdown of systems when scheduled.
   3. Calibration of sensors
   4. Testing shall affirm winter and summer design conditions.
   5. Test under full outside air conditions.
   6. Confirm functionality of all specified sequences of operations.
   7. Verify the functionality of all alarms.

D. Performance criteria
   1. Air and water temperatures shall be within tolerances specified in the contract documents.
   2. Space temperatures shall be maintained within 1 degree of specified set points.
   3. Space humidity shall be maintained within 5% of specified levels.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor’s responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

C. Refer to commissioning plan for detailed list of equipment to be commissioned.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. DBR has included a small contingency for limited retesting, however DBR reserves the right to stop testing on a system when the system:
   1. Does not have the correct graphics programmed.
   2. Does not have the correct data trends programmed.
   3. Does not have the correct set points programmed.
   4. Does not have the equipment or system safeties installed and programmed correctly.
   5. The TAB data forms have not been submitted to our firm or the performance of the system listed on the TAB forms is not per project requirements.
   6. Line items of the functional performance test have failed.

F. Sampling
   1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
   2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
   3. A common sampling strategy is the "xx% Sampling - yy% Failure Rule", defined by the following example.
      a. xx = the percent of the group of identical equipment to be included in each sample.
      b. yy = the percent of the sample that if failing, will require another sample to be tested.
      c. The example below describes a 20% Sampling - 10% Failure Rule.
      d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
      e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
      f. If 10% of the units in the second sample fail, test all remaining units in the whole group.
      g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

G. Re-Testing And Failure To Remedy Deficiencies

1. Despite Contractor's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
    a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor's control to resolve expeditiously.
    b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.
    a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

H. Deferred Testing
1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
1. Purpose of equipment.
2. Principle of how the equipment works.

3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

D. Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:
1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 23 09 53 - REFRIGERANT MONITOR SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Refrigerant monitoring system and all related controls and accessories.

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 09 63 - Energy Management and Control System (EMCS)

C. Section 23 64 16 - Centrifugal Water Chillers

D. Section 23 64 26 - Rotary Screw Water Chillers

1.4 REFERENCES

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

B. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 QUALITY ASSURANCE

A. Refrigerant monitoring system shall be configured to meet ASHRAE Std 15, B-52 and all ICC (IMC) International Mechanical Code and ICC (IFC) International Fire Code requirements.

B. All monitoring system wiring shall be in accordance with NFPA 70.

C. Installation and Start-up: Provide services of a representative authorized by the manufacturer to perform inspection, start-up and certification of system.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment
2. Principle of how the equipment works
3. Important parts and assemblies
4. How the equipment achieves its purpose and necessary operating conditions
5. Most likely failure modes, causes and corrections
6. On site demonstration

PART 2 - PRODUCTS

2.1 GENERAL

A. The gas monitoring system shall continuously measure and display the specified gas concentration. The system shall provide visual indicators when preset limits are exceeded. Relay output for alarms and control shall be provided.

B. Gases detected and the detection range shall be as follows:

Gas	Range/Full Scale
R-123	0 - 1,000 ppm
R-1233zd	0 - 1,000 ppm
R-134a	0 - 1,000 ppm
R-513A	0 - 1,000 ppm
R-515B	0 - 1,000 ppm

2.2 SYSTEM CONFIGURATION

A. Description - The system may consist of one of the following configurations:
   1. Base remote sensor module including the Photoacoustic IR (PAIR) sensor, power supply.
   2. Split construction with a control module and remote sensing module.
   3. Stand-alone type with integrated control and sensing modules in a single enclosure.

B. Sensor Module - The unit shall be a wall mount type. It shall conform to Paragraphs 1 through 9.
   1. NEMA 4X enclosure
   2. Photoacoustic IR Sensor.
   3. Five LED status indicators.
   4. 24 VAC or VDC operation or 110/220, 50/60 Hz options.
   5. Optional beacon
   6. 4-20 mA and RS-485 ModBus outputs.
   7. Single channel diffusion or optional pump sampling.
   8. 4-channel sequencer with sample solenoids can be added as an option but requires the use of the Control Module to drive the sequencer.
   9. 20 PPM detection limit.

C. Control Module - The unit shall be a wall mount type. It shall conform to Paragraphs 1 through 9.
   1. Enclosure Type - The enclosure shall be a NEMA 4X version.
   2. The control module shall feature digital signal processing with RS-232 system compatible. A 4-20 mA output and 0-10VDC shall also be available.
   3. Accepts up to 8 remote sensor inputs over a single pair cable or up to 2 remote sensors with 4-channel pump/sequencer or any combination up to 8 channels.
   4. Digital Display with optional remote display.
   5. Three levels of Alarm and Fault indicators.
   6. System configured via the front panel keypad.
   7. Provides 24VDC power to operate remote sensors.
   8. An 85 Db audible alarm with an acknowledge switch shall be available as standard on the control module.

9. A visual alarm strobe shall be available as an option on all units. System power shall be 110/220 VAC 50/60 Hz.

D. Stand - Alone, Integrated Unit - The unit shall be wall mount type. It shall conform to Paragraphs 1 through 9.
   1. Photoacoustic IR sensor
   2. Diffusion operation or pumped with up to 4 sampling points.
   3. 20 PPM detection limit
   4. Digital signal processing
   5. Digital display with optional remote display
   6. 4-20 mA, 0-10VDC and RS-232 Outputs standard.
   7. Three levels of Alarm and Fault status indicators.
   8. System configured via the front panel keypad.
   9. Enclosure Type - The enclosure shall be a NEMA 4X version.

E. Operating Principle - The principle of operation shall be of the infrared photo acoustic absorption type.
   1. Analyzer Sample - Any version of the analyzer may be configured as a diffusion type monitor or be equipped with an internal pump and filter that can draw a sample from a distance of 300 feet. All sample connections shall be on the bottom of the enclosure.
   2. Analyzer Sensitivity - The analyzer limit of detection for all refrigerants shall be 20 PPM.
   3. Analyzer Linearity - The analyzer shall be within +/-5 PPM of a linear response in the range of 0-100 ppm and + 5% of full scale in the range of 100-1000 ppm.
   4. Temperature - The system shall operate over the range of 0o to 45o C.
   5. Stability - The 24 hour zero or span drift must be less than 5 PPM. The long term (1year) zero drift shall be less than 5 PPM. The long term span drift shall be less 10 PPM.

F. Calibration: The calibration of all versions shall be performed using standard RP cylinders and existing calibration equipment.

2.3 MONITOR UNIT REQUIREMENTS:

A. Readout Displays - A 2 line x 20 character alpha numeric display shall be provided for the purpose of displaying the gas concentration, diagnostics, set-up and calibration menu.

B. Visual Alarm Indicators - All alarm indications shall be displayed on the front panel display.

C. Alarm Set Point Levels - Three separate alarm set point levels shall be provided. The set points shall be independently adjustable for any value for a given range. The set points shall provide drive signals to user interface relays. The alarm set points shall have the capability of providing the user a selection of latching or non--latching.

D. Relay outputs - The alarm set point drive signals shall activate user relays as specified in Paragraphs 1 through 4.
   1. Number of Relays - As a minimum, one relay for each alarm set point level shall be provided on the control unit.
   2. Contact Rating - All relays shall be Form C, single pole, double throw. Dry contacts shall be rated for 5 amps resistive at 240 VAC.
   3. Contact Selection - The contacts shall be capable of being selected normally energized or non-energized, latching or non-latching.
   4. The Trouble (Fault) relay is normally energized and closed for normal conditions. If a system fault is detected the Trouble relay will de-energize.

E. Malfunction Indication - The readout display described in Paragraph 1.5.1 shall display full diagnostics when a fault exists without the use of codes.

F. Audible Alarm - An audible buzzer is included; it sounds when one of the three pre-selected alarm conditions or a trouble condition occurs.

G. Front Panel Controls - The function listed in this paragraph shall be accomplished using a keypad readily accessible on the front panel.
   1. No tool or special adapters shall be used for:
      a. Display of alarm set point level on the readout display.
      b. Resetting any alarm set point
      c. Zero and Span calibration adjustment

H. Sample Gas Filter - There shall be an internal sample gas filter on pumped units. This filter shall be easily serviced or replaced.

I. Output Signals
   1. The 4-20 mA output shall have the following features:
      a. Scalable to 1-10% of the full scale. The default shall be 100% full scale.
      b. The output shall be sourcing current to module ground.
      c. For refrigerants, software will have a dead-banding feature not allowing a value less than 10 PPM to be displayed on the front panel.
   2. RS-485 using ModBus communication protocol will be included in all sensor modules.
   3. The control modules will have an ATO output option of RS-232, 4-20mA, or 0-10VDC.
   4. The 10 volt analog output may be used to identify the station being monitored in a multipoint sequencing unit.

J. System Power Requirements shall be standard at 24 VDC or VAC. Optional input voltages shall be available for either module at 110 or 220 VAC, 50/60 Hz.

K. Multi Point Capability - The system shall be expandable to include a Multi-Point Sequencer with up to four (4) sampling points. Use of the sequencer requires the Control Module for control.

L. System must be capable of allowing the user, through the front panel keypad, to determine which of the four (4) points are to be active in the sequencer.

M. A method of detecting a flow blockage shall be provided.

N. Sequencer Programming Limits - The sequencer system parameters shall be within the following limits.

O. Sample Tubing Connection - Fittings suitable for the connection of 1/4" O.D. tubing shall be provided on the bottom of the enclosure for the purposes of connection, sample lines, calibration gases and exhaust.

P. Alarm - Three alarm set point levels shall be provided for each sample location. Any alarm set point shall be capable of activating one relay (SPDT, 8 amp at120 VAC, resistive).

Q. Indicating Lights - All indications related to the Multi Point Sequencer shall appear on the front panel display.

R. Software shall be installed in the pumped versions to allow the user to enter the station dwell time to allow for the line length and sample transport time for each sensor.

2.4 SAMPLE HANDLING

A. Sample Line Compatibility - The system shall be capable of drawing a sample through 1/8" I.D. tubing for a distance of 300 feet.

B. Sequencer Operation - A sample shall be drawn from the next line in sequence regardless of which location is being analyzed.

C. Sample Conditioning - The system shall provide adequate filtration of the sample suitable to protect the analyzer.

D. Exhaust - Exhaust fitting shall be provided on the bottom of the enclosure for the purpose of attaching lines to the exhaust and bypass flows.

2.5 SYSTEM MAINTENANCE REQUIREMENTS

A. Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.

B. Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
   1. Be capable of supplying all equipment used to check or calibrate the unit
   2. Be capable of providing onsite service with factory trained personnel
   3. Be capable of providing start-up assistance and training for the owner / operator

2.6 EMERGENCY SIGNS

A. Emergency signs shall be provided in accordance with NFPA 704. Signs shall include a warning that the visual and audible alarms indicate a refrigerant leak has been detected and the monitored area should be evacuated. Sign material shall be engraved, laminated, UV resistant plastic or etched metal with self-adhesive backing. Submittals shall include sign material, dimensions, color, lettering format, and warning message for approval.

2.7 ACCEPTABLE MANUFACTURERS

A. Mine Safety Appliances Company Chillgard 5000

B. Honeywell Analytics model 301EM-20

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

C. The Gas Monitoring System shall be tested, approved, and certified for electrical safety.

D. Emergency signs shall be installed outside each exit door to monitored rooms. Install signs near alarms located at exits where they can be easily seen. Coordinate final locations with the Architect and Owner prior to installation.

3.2 SPARE PARTS

A. Provide at least 1 spare device for each type of gas detection sensor specified herein.

3.3 COMMISSIONING

A. After installation, test equipment to demonstrate operation of functions as described in the sequence of operations.

B. Manufacturer shall include services for the commissioning of the system.

C. After installation, provide test gas and required accessories to calibrate and verify proper operation, according to sequence of operation.

D. Provide testing kits, including gas bottles, for testing and calibration.

E. Provide demonstration and training for operations personnel.

F. Provide a system manual with operation and testing instructions. System manual shall include test forms and documentation of the initial calibration, testing and certification. System manual shall be submitted with O&M manual and distributed to operational personnel at time of training.

END OF SECTION

SECTION 23 09 63 - ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

PART 1 - GENERAL

1.1 GENERAL

A. The Energy Management and Control System (EMCS) shall be comprised of a Local Area Network (LAN) infrastructure, Operator Workstations (OWS), Engineering Workstations (EWS), a Primary Network Server (PNS), Network Area Controllers (NAC), Application Specific Controllers (ASC), Unitary System Controllers (USC), and Field Devices installed within the facility. The EMCS Contractor shall provide a completely wired system. Wireless components and wireless communication are not acceptable.

B. The Workstations, Primary Network Server, and Network Area Controllers shall be connected by a EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in the latest revision of IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

C. If the EMCS contractor wishes to connect to the Owner's Wide Area/Local Area Network as part of the control system network, the EMCS contractor shall acquire permission in writing and include the letter in the submittal. Any system that requires connection to the owner's network for communication between NAC, ASC, USC and/or field devices that is submitted without the written permission from the owner shall be rejected. The EMCS Contractor shall coordinate with the Owner and supply all required information.

D. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. The facility shall be integrated into the existing Fort Bend ISD District Wide Energy Management Server. All energy data, food service monitoring, lighting controls and BAS HVAC alarms shall be provided and commissioned as per district standards. Depict each mechanical system and building floor plan by a point-and-click graphics. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface. If individual software seat licenses or keys are required provide a minimum of 4 additional licenses to accommodate multiple owner operators.

E. Access to the system, either locally in the building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the Internet and/or a local area network.

F. All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ASHRAE Std 135, latest revision. Management level TCP/IP Ethernet network speeds shall be 1 Gbps minimum and the Automation Level MS/TP network speeds shall be 76.8 Kbps minimum.

G. The Server shall gather data from the system and generate HTML pages accessible through a conventional web browser from all personal computers (PCs) connected to the network. System shall include any and all software and hardware to support at least 50 simultaneous users. The EMCS shall be compatible with all common web browsers.

H. Facility Operators shall be able to view and configure systems through the standard web browser and all graphical/data representations shall appear identical, whether the user is on site or viewing via the Internet at a remote location. Standard operator functions such as control point manipulation, configuration and viewing of trends, schedules and alarms shall be performed through the standard browser. Each mechanical system and building floor plan shall be depicted on the operator workstation by point-and-click graphics.

I. The EMCS shall directly control HVAC equipment as specified in the Sequence of Operations. Furnish Energy Conservation features such as Optimal Start/Stop, Night Setback, Setpoint Reset logic, and Demand Control Ventilation.

J. The EMCS vendor shall provide the following additional services as part of this specification: warranty and service during the warranty period; submittals, samples and record documentation; comprehensive startup and testing of the EMCS with documentation; training services for the owner and facility operators; coordination with other contractors and suppliers; operator and technician training program, and shall cooperate fully with the Project Commissioning Agent.

K. Products furnished under this specification but installed by others.
   1. Mechanical devices installed under Division 23 by the mechanical contractor or other suppliers:
      a. Temperature sensing thermowells.
      b. Automatic control valves and actuators.
      c. Pipe taps for flowmeters.
      d. Water pressure sensors and switches.
      e. Automatic control dampers and actuators not installed in air handling unit mixing boxes or louvers.
      f. Damper actuators for automatic control dampers installed in air handling unit mixing boxes.
      g. Damper actuators for variable air volume (VAV) terminal units.
      h. Mounting cost of controller and actuator for variable air volume (VAV) terminal units.
   2. Electrical devices installed under Division 26 by the electrical contractor:
      a. 120 VAC power to controllers and control panels at locations indicated on the drawings. Review and verify that these locations are adequate for the proposed EMCS.
      b. Interlock wiring to duct mounted smoke detector or fire alarm shutdown relays to HVAC equipment motor starters and variable frequency drives (VFD).

L. Provide and install all interconnecting cables between all operator’s terminals and peripheral devices (such as printers, etc.) supplied under this section.

M. DDC system to be tied in to emergency button/switch to initiate shut down of all HVAC equipment when activated.

N. System shall be fully compatible and interface with School Dude FS Direct. Owner shall be able to use Maintenance Direct for Actions on individual Areas as needed and requested by owner. Contractor responsible for all hardware, software and coordination involved.

O. It is the contractor's responsibility to discover and integrate all devices and points into system as necessary. This includes, but not limited to, HVAC, electrical, plumbing and lighting devices.

P. It is the intent of this specification to describe the basic architecture and performance requirements of the Energy Management Control System (EMCS). The turn-key EMCS shall include all work station software including operator software, cables, programming tools, graphics editor, all other available software programs, modules, handhelds, or plug-ins offered by the DDC manufacturers, hardware, Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments and fine tuning necessary for a complete and fully operational system.

Q. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these specifications shall relieve the contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.

R. All systems shall be complete true stand-alone systems. Program database, data acquisition, and all control sequence logic shall reside in each DDC Device. The Building Level Communication Network (BLCN) shall not be dependent upon connection to a Server or Master Controller for the performance of the Sequence of Control as outlined in this specification. Each Device shall, to the greatest possible extent, perform its programmed sequence without reliance on the BLCN.

S. All devices installed shall be native BACnet. Lonworks or proprietary protocols are not allowed. Devices that are not BACnet tested, compliant, certified, clearly stamped and listed by the BACnet Testing Laboratories (BTL) shall not be acceptable under this specification and are strictly prohibited.

T. System shall be provided with a complete Web-enabled operator interface. The application shall operate on industry standard PC hardware. Proprietary server hardware or “Black Boxes” will not be acceptable. Third party Web-enabled applications are acceptable if they are configured to be indistinguishable from the OWS applications.

U. Programming of software shall be written in BASIC STRUCTURED logic that client is familiar with and not written within CORE spec engineering.

V. No Gateways, Communication Bridges, Protocol Translators or any other device that translates any proprietary or other communication protocol to the BACnet communication the protocol shall be permitted as a part of the BAS installation under this specification section. Gateways may only be used as required for communication to existing systems or systems installed under other specification sections.

W. All BAS DDC Devices shall be capable of updating firmware using software via the internet without replacing any hardware, microprocessors or chips.

X. Installed system must have full access to logic and functional blocks. User shall have full ability to modify programming.

Y. Outside air temperature shall be supplied by the National Weather Service with a local backup at every site.

Z. Point naming/labeling shall be consistent throughout buildings.

AA. Where drawings are provided as part of or supplement to these specifications, such drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.

BB. System shall have the ability to program schedules locally if needed during network outages.

1.2 RELATED DOCUMENTS & REFERENCES

A. Drawings and general provisions of the contract documents, apply to this section including:

1. Division 01 for General Conditions and Supplementary Conditions.
2. Division 21 for fire protection equipment.
3. Division 22 for plumbing equipment and domestic water systems.
4. Division 23 for mechanical equipment, ductwork, and piping systems.
5. Division 26 for electrical equipment, lighting control, and fire alarm systems.

B. The latest edition of the following standards and codes in effect as approved by the authority having jurisdiction and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
1. ANSI MC85.1 - Terminology for Automatic Control.
2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
3. ASHRAE Std 135 - BACnet.
4. BTL Mark by the BACnet Testing Laboratories.
5. Uniform Building Code (UBC), including local amendments.
6. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
7. NFPA 70, National Electrical Code (NEC).
8. FCC Part 15, Subpart J, Class A.
9. National Institute of Standards and Technology (NIST).
10. IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

1.3 RELATED WORK IN OTHER SECTIONS

A. Refer to Division 00 and Division 01 for allowances and related contractual requirements.

B. Refer to Division 21 for General Fire Protection Provisions and fire suppression pump.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

C. Refer to Division 22 for General Plumbing Provisions, domestic water heating systems, domestic water pumping systems, domestic water metering, and natural gas metering.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

D. Refer to Division 23 for General Mechanical Provisions for equipment such as chillers, cooling towers, boilers, pumps, air-handling units, terminal units, ventilation fans, variable frequency drives, unitary AC units, etc.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

E. Refer to Section 26 for General Electrical Provisions for equipment such as electrical switchgear control, electrical power monitoring, emergency generators, lighting control system, etc.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

1.4 ELECTRICAL POWER PROVISIONS

A. Primary power will be provided under Division 26 by the electrical contractor to the panel locations indicated on the mechanical & electrical drawings. Provide step down transformers within panel enclosures. Provide all necessary fuses and circuit protection devices.

B. Power will be provided to the controllers serving fan powered terminal units with electric heat via the control transformer provided with the unit.

C. All components of the EMCS shall be powered from the sources above. Provide final terminations from the locations indicated on the Division 23 Drawings.

D. The EMCS Contractor shall provide any additional control power that is required as part of this contract and not indicated by other. This shall include all conduit, cabling, circuit breakers, etc.

1.5 CONTRACTOR QUALIFICATIONS

A. The EMCS Contractor shall:
1. Have a local office within 100 miles of jobsite before bid date and at a minimum until the completion of the warranty period.
2. Have a local staff of trained personnel capable of giving instructions and providing routine and emergency maintenance on the EMCS, all components and software/firmware and all other elements of the EMCS.
3. Have a proven record of experience in the supply and installation of equivalent BACnet systems over a minimum period of five years. Provide documentation of at least three equal and complexity, if so requested by the Owner’s Representative.
4. Be a factory certified representative of the native BACnet EMCS manufacturer for design, installation, and service of the proposed system.
5. Have comprehensive local service, training and support facilities for the total EMCS as provided. Maintain local, supplies of essential expendable parts.
6. Have a local 24/7 phone service support.

1.6 SUBMITTALS

A. ALL DOCUMENTS SUBMITTED SHALL BE IN NATIVE PDF FORMAT. NO SCANS.

B. Shop Drawings:
1. The following information shall be included on the cover page for each shop drawing and equipment documentation submittal:
    a. Project name with date. Refer to the applicable specifications by name and number.
    b. Provide submittal number and re-submittal number and date as applicable.
    c. Provided name and address of Consulting Engineer, Mechanical Contractor, General Contractor
2. Shop drawings shall be CAD generated, plot size of 8-1/2” x 11” or 11” x 17”. Drawings shall include diagrams, mounting instructions, installation procedures, equipment details and software descriptions for all aspects of the system to be installed.
3. Provide schematic of systems indicating instrumentation locations, all interconnecting cables between supplied cabinets on a mechanical floor plan.
4. Software specifications and descriptions including operating sequences.
5. Provide a bill of material that indicates specific manufacturer, part number, part description and quantity of each device for all system components.
6. Provide a list of the wire labels to be installed on each end of the control wiring, at the device and the control panel terminal. Labels shall be machine generated, typed and legible with a maximum of 17 characters. The label description “AHU-1 SAT” shall indicate the supply air temperature of AHU-1.

7. Equipment Schematic: Provide an electronic equipment schematic for each piece of mechanical equipment. The schematic shall display all mechanical equipment characteristics including fans, dampers, valves, sensors and other applicable control devices. The schematic shall show wiring terminations to each control device as shown in the submittal and as-build documentation. Control devices shall be labeled by a symbol that can easily be identified in a bill of material that is shown on this graphic. The bill of material shall show the device symbol, description, manufacturer and part number.
8. Sequence of Operations: The control sequences shall be viewable for each piece of mechanical equipment and be in a text format as shown in the as built documentation. The sequence of operations shall be selectable at the applicable location for the control program.

C. Control component submittals:
   1. Component technical data sheets with mounting and installation details.
   2. The documentation shall include comprehensive and complete details of the BIBB and automation level documentation including address, associated controller type, etc. as required and for the interface to the EMCS.
   3. Details of networks/communications equipment, cabling and protocols proposed. Provide schedule of cabling including details of proposed cable types.
   4. Module Drawing: Provide an electronic wiring diagram of each control module (as shown in submittal documentation). Diagram shall display wiring schematic and terminations to end devices. Diagram shall display each input and output terminals and label those that are used for the control application. Diagram shall display module type/name and network address.
   5. Field sensor and instrumentation specification sheets. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
   6. Schedule and specification sheets for dampers, valves and actuators.
   7. Design and provide layout of all components of panel mounted control devices, terminal strips and power supplies.

D. Colorgraphics: Provide sample layout of color graphic representations of the systems for review. The submittal shall indicate the quality of the graphic to be provided with the system with a sample of the specific control points to be included. Control points shall as a minimum include points indicated in the input/output summary, control schematic and primary controlling points defined in the sequences of operation. Provide a sample of a floor plan layout, typical AHU, terminal unit, outside air pretreatment unit, variable frequency drive, exhaust/supply fan, chiller plant and hot water plant. For control points to be provided by equipment BACnet integration provide sample of the control points, up to 25 total.

E. Verification Reports: The submittal shall include a sample of the verification reports to be utilized during the verification section of this specification. Sample reports shall be approved as submitted or be modified by the engineer or owner's representative. The verification reports shall be included in the final Operation & Maintenance Manuals. Reports shall be provided in electronic PDF format.
   1. Project Systems Verification Form for each controller.
      a. General information for each form shall include: project name; associated equipment with mark number; control panel number and location; controller number and model number; controller device instance number (address); MS/TP LAN segment number; verifying technician and date.
      b. Each connected control point and device shall contain the following columns with a separate line for each connected physical point: point description (same as device label); input/output number for each connected control device (AI-XX, AO-XX, DI-XX, or DO-XX).

c. Check boxes confirming that the verification tasks have been completed: device location, proper termination at device; proper termination at control panel; sequence is verified; point trend is enabled.

d. Data entry boxes indicating measured/confirmed values: preliminary control point value on the graphic; observed control point value; calibration or adjustment value to correct offset; final displayed point value on the color-graphic; date of verification; engineer or owner's representative verification.

2. Control Panel Verification Form for each control panel.

a. General information: panel location and identification number; panel dimensions and NEMA rating; panel properly installed; Class 1 and Class 2 wiring are properly separated; correct voltage to the panel; no shorts or grounds in panel; no induce voltages in panel wiring; point to point termination match submittal; devices are mounted in the correct location; controller software revision number; address of controllers; panel device checkout is complete; panel startup is complete.

3. Sequence of Operation Verification Form per piece of equipment (AHU, VAV, chiller, boiler, etc.).

a. General information: project name; system identifier; building area served; control panel and controller numbers; controller model number and instance number (address); MS/TP LAN segment number; name of verifying technician and date.

b. Each step of the sequence of operation for each piece of equipment shall be documented shall include a "description of test", "input to trigger test" and "expected outcome". A pass/fail checkbox shall indicate each of these actions. Provide space for technician approval with associated date.

F. Operating and Maintenance (O&M) manuals: Provide O&M manual with full information to allow the owner to operate, maintain and repair installed products. Include trade names with model numbers, color, dimensions and other physical characteristics.

1. Format: Produce on 8-1/2 x 11-inch pages, and bind in 3-ring/binders with durable plastic covers. Label binder covers with printed title "OPERATION AND MAINTENANCE MANUAL", title of project, and subject matter and "Number _ of _" of binder. Provide substantial dividers tabbed and titled by section/component number.
2. Table of Contents for each volume:

a. Part 1: Directory with name, address and telephone number of Designer, Contractor and Subcontractors and Suppliers for each Project Manual section.

b. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical and where not, by system. Include:

3. Product design criteria, functions, normal operating characteristic and limiting conditions. Installation, alignment, adjustment, checking instructions and troubleshooting guide. Operating instructions for start-up, normal operation, regulation and control, normal shutdown and emergency shutdown. Test data and performance curves.
4. Spare parts list for operating products, prepared by manufacturers including detailed drawings giving location of each maintainable part, lists of spares recommended for user-service inventory and nearest source of in-stock spares.

G. Record Documentation:

1. Details of all alarm, diagnostic, error and other messages. Detail the Operator action to be taken for each instance.
2. Detail special programs provided and provide a complete programming instruction manual. Detail operation of all software applications.
3. Detailed list of the database for all installed devices.
4. Record drawings shall be CAD generated and shall include final locations and point ID for each monitored and controlled device.

5. In additional to the required hard-copies, provide a CD-ROM with all of the record documentation in PDF format and a CD-ROM containing backup copies of all installed software and graphics.
6. Online as-built documentation: provide digital replications of as-builts that shall be accessible from each equipment graphic controlled or monitored by the EMCS.

1.7 WARRANTY

A. Warranty work and the equipment provided under this contract shall be for a period of one year from the date of Substantial Completion. Warranty shall cover all components, system software, parts and assemblies supplied by this contractor and shall be guaranteed against defects in materials and workmanship for one (1) year from the date of Substantial Completion. Labor to troubleshoot, repair, reprogram or replace system components that have failed due to defects in materials and workmanship shall be provided by this contractor at no charge to the owner during the warranty period. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks. All warranty work shall be performed by the EMCS contractor's local service group.

B. No portion of the total contract will be declared substantially complete until the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.

C. Warranty shall not include routine maintenance, e.g., equipment cleaning, mechanical parts lubrication, pilot lamp replacement, operational testing, etc. Warranty shall not cover repair or replacement of equipment damaged by under- or over-voltage, misuse, lack of proper maintenance, lightning, water damage from weather or piping failure.

D. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the EMCS contractor. The maximum acceptable response time to provide this service at the site shall be 24 hours, during normal working hours.

1.8 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration that includes hands-on demonstration of the manipulation of setpoints, schedules and other adjustable elements of the system.
   7. The demonstration shall be on the actual, completed graphic interface pages for the specific project.

B. Provide a second training session 3 months after initial session for any follow-up or additional training requested by owner's personnel. Allow 3 hours for the second training session.

1.9 OPERATOR WORKSTATION (OWS)

A. The Operator Workstation shall be any personal computer, connected to the LAN, with appropriate web browser software installed.

1.10 ENGINEERING WORKSTATION (EWS)

A. The Engineering Workstation shall be any personal computer, connected to the LAN, with a registered copy of the EMCS contractor supplied engineering and/or programming software installed. The EMCS contractor shall provide at least one copy of all required software(s), to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.

B. The EMCS shall provide one personal computer (PC) which is compatible with the performance required by the EMCS Engineering Software if an engineering workstation is specified for the system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE EMCS VENDORS

A. AUTOMATED LOGIC - Branch Office

B. RELIABLE CONTROLS - Unify Energy Solutions

2.2 PRIMARY NETWORK SERVER (PNS)

A. The EMCS Contractor shall provide and install the Primary Network Server as part of this system. The PNS shall utilize the Internet and provide efficient integration of standard open protocols. The PNS shall maintain comprehensive database management, alarm management and messaging services, and graphical user interface as follows:
   1. Support an unlimited number of users over the Internet/intranet with a standard web browser to access alarms, trend logs, graphics, schedules and configuration data. Access to the PNS shall be password protected utilizing authentication and encryption techniques. An audit trail of database changes indicating user, time stamp, and audit action shall be provided.
   2. Enterprise level information exchange using an SQL database and HTTP/HTML/XML text formats.
   3. Synchronize controller databases, database storage scheduling, control and energy management routines
   4. Alarm processing and routing which includes email, SMS text messages and paging.
   5. HTML5 based help system that includes comprehensive online system documentation.
   6. Support of multiple Network Area Controllers (NAC) connected to a Local Area Network.
   7. Aggregate data and provide visualization interface and dashboard that includes, but is not limited to, graphs, gauges, charts of relevant trends and energy usage.

B. Server Functions
   1. It shall be possible to access all Network Area Controllers (NAC) via a single connection to the server through the Ethernet LAN. In this configuration, each Network Area Controller can be accessed from a single user login.
   2. The PNS shall provide the following functions, at a minimum:
      a. The server shall provide complete access to distributed global data. The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
      b. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.
      c. The server shall provide scheduling for all NACs and their underlying field control devices.

d. The server shall provide demand limiting control that operates across all NACs. The network server shall be capable of multiple demand limiting programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

e. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

f. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include: routing of alarms to a video display, a printer, an email and pager; view and acknowledge alarms; query alarm logs based on user-defined parameters.

g. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.

h. The server shall provide central management of logged data for all NACs supported by the server. Logged data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: viewing and printing log data; exporting log data to other software applications; query log data based on user-defined parameters.

i. Storage of the graphical screens shall be in the network web server without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

j. Modify common application objects, such as schedules, calendars, and setpoints in a graphical manner. Schedule times will be adjusted using a graphical slider. Holidays shall be set by using a graphical calendar.

k. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

3. The Primary Network Server shall be capable of supporting the following open system drivers;

   a. BACnet/IP

   b. Modbus TCP

C. Network Server Platform Requirements

1. Rack-Mounted Server Computer Hardware: DELL PowerEdge R220 or equal, Intel Xeon Gold 3.0 GHz or higher, 32GB RAM, 2 TB hard drive, video card, 22” color monitor, and Ethernet adapter 1Gbps or higher.
2. Operating system software shall be Microsoft Windows® 10 Professional or higher.

2.3 NETWORK AREA CONTROLLER (NAC)

A. Provide one or more Network Area Controllers (NAC) to meet the sequence of operations and the type and quantity of devices being integrated into the system. The NAC shall provide the interface between the local area network and the field controllers. The NAC shall provide global supervisory control functions over the associated controllers and shall be capable of executing application control programs to provide: calendar functions; scheduling; trending; alarm monitoring and routing; time synchronization; integration of controller data for each applicable protocol; network management functions for all network devices. The user may view real-time information via web-based data.

B. The Network Area Controller shall provide the following hardware features as a minimum: Ethernet Ports 100Mbps or higher, BACnet MS/TP ports, battery backup, DDR RAM memory, flash memory for long term data backup.

C. Provide an uninterruptible power source (UPS) per network controller to maintain operation for 1 hours.

D. The NAC shall be capable of operation over a temperature range of 32 to 122 °F and operation over a humidity range of 5 to 95% RH, non-condensing; storage temperatures of between 32 and 158 °F.

E. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

F. The NAC shall be capable of supporting the following open system drivers;
   1. BACnet/IP
   2. BACnet MS/TP
   3. Modbus TCP
   4. Modbus RTU

G. Controls engineer to place all main equipment like chillers, cooling tower, boilers and domestic water systems on main module (or backbone) and subdivide building’s wings and floors by using AAR sub-modules on communication network. Assist field technicians for easier troubleshooting and downtime.

H. Event Alarm Notification and actions: The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. Alarm conditions shall be routed to any defined user location whether connected to a local or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to: alarm; return to normal; fault.
   2. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc. Allow timed routing of alarms by class, object, group, or node.
   3. Provide alarm generation from binary object “runtime” and/or event counts for equipment maintenance (i.e. filter status, fan run status). Authorized users shall be able to reset runtime or event count values with appropriate password control.
   4. Control equipment and network failures shall be treated as alarms and annunciated.
   5. Alarms shall be annunciated in any of the following manners as defined by the user: screen message text; e-mail of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on: day of the week, time of day and recipient.
   6. Color-graphic shall have flashing alarm object(s). Printed message may be routed directly to a dedicated alarm printer.

7. The following shall be recorded by the NAC for each alarm (at a minimum): time and date; location (building, floor, zone, office number, etc.); associated equipment. Upon acknowledgement of the alarm the NAC shall document the time, date and authorized user. The number of alarm occurrences since the last acknowledgement shall be recorded.
8. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user. Alarm actions may be initiated by user defined programmable objects created for that purpose.
9. Alarm archiving: A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user. Provide a “query” feature to allow review of specific alarms by user defined parameters. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
10. Provide ability for user to clear nuisance alarms.

I. Data Collection and Storage: The NAC shall have the ability to collect data for any property of any object and store this data for future use.
1. The user shall designate the log as an interval log or deviation log. For an interval log, the object shall be configured for time of day, day of week and the sample collection interval. For deviation log, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
2. All log data shall be stored in a relational database in the NAC and the data shall be accessed from the server or a standard web browser. All log data, when accessed from the server, shall be capable of being manipulated using standard SQL statements.
3. All log data shall be available to the user in the following data formats: HTML, XML, plain text, comma separated values, as a minimum.
4. The NAC shall have the ability to archive its log data either locally or remotely to the server or other NAC on the network.

J. Local Access: The NAC shall provide redundancy of system access to the local controllers at the remote building if the Primary Network Server should lose communication or be off-line. The NAC shall maintain setpoint and scheduling features, access to the color-graphic displays, maintain trend logs and reports. Upon restoration of communication with the PNS the archived information shall be transmitted to the server for archiving.

2.4 SOFTWARE FOR THE NAC

A. The distributed architecture of the operating system for the PNS and NACs shall provide the operator a comprehensive interface to allow the operator to configure and customize the EMCS to optimize the HVAC system to save energy, schedule and maintain equipment and provide occupant comfort. The provided graphical toolset shall allow the operator to create applications in a drag and drop environment.
1. Input/output capability shall allow the operator to request the current value or status of the control point; command/override equipment to a specific state; add, change or delete control points, alarm limits and controllers; change descriptors to control points and equipment; modify parameters; create or modify DDC loops.

B. Operator System Access: Via software password with five access levels at workstations and at each control unit.

C. Color graphic tools shall allow the user to create equipment and floor plan graphics from a standard library of symbols; allow custom generation of symbols; utilize over 64 or more colors; create real-time dynamic data for the graphics. Up to 60 control points may be displayed on each graphic.

1. Provide a link between compatible graphics to minimize the paths to additional information. For example, provide the link from the zone sensor to the VAV terminal to the air handling unit and to the central plant. Web pages shall be provided to allow the operator to zoom into specific areas of the facility and then link the space to the floor plan to the overall building and then to the facility site plan.
2. Graphical tools shall allow the creation of bar graphs, pie graphs and other tools to visualize control information such as run time hours, energy consumed and occupant comfort.
3. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, PDF, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
4. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML5 or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.

D. Alarm processing tools shall allow the operator to create alarm messages that include as a minimum: time of alarm, point descriptor, alarm condition and remote annunciation. Critical alarms shall be displayed, archived to a storage device or printed on a alarm printer. Alarms shall be displayed in order of occurrence and have an optional audible alarm indicator.
1. Print alarm messages, up to 60 characters in length, for each alarm point specified.
2. Alarms may be routed to other devices including web-enabled cell phones, pagers, tablet PCs and designated personal computers on the network or Internet.
3. Operator specifies when alarm requires acknowledgment. Continue to indicate unacknowledged alarms after return to normal. An alarm log shall be maintained to archive alarms for future reference with the above specified parameters as well as indicating the person acknowledging the alarm.
4. The graphical display shall indicate the number of the current unacknowledged alarms by individual building site or by sum of all campus-wide facilities.
5. The operator may create and forward an e-mail message to another user directly from the graphical interface so that the message can be read when the second user logs on to the system.

E. Upon a power failure to equipment in the facility, the EMCS shall automatically start equipment upon the restoration of power. Program a time delay between individual equipment restart on a schedule to minimize demand charges from the utility company.

F. Custom reports may be created by the operator with a requested time and date manually or automatically. All reports may be logged to a storage device for future reference. The data reports shall allow customization and scaling of the X-Y coordinates; plotting of tabular reports; provide multi-point graphical reports with not less than eight variables on the same report. Print reports on daily, weekly, monthly, yearly or scheduled basis as scheduled.

G. The network server current operating system, database, color-graphics, custom reports shall be backed up automatically to a remote server or storage device as directed by the owner's representative.

H. Maintenance Management capability shall allow the system to monitor and log the run-time for HVAC equipment; schedule maintenance reports that include recommended material and labor for the assigned task.

2.5 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, CHW loop pressure control. The differential pressure sensor and the pump VFD ramp signal.)

B. ASCs shall be capable of implementing control strategies for the system based on information from any or all connected inputs. The AC shall utilize factory pre-programmed global strategies that may be modified by field personnel on-site. Global control algorithms and automated control functions should execute via a 32-bit processor

C. Programming shall be object-oriented using control program blocks that will support a minimum of 500 Analog Values and 500 Binary Values. Analog and binary values shall support standard BACnet priority arrays. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing.

D. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1 year (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. The onboard, battery-backed real time clock must support schedule operations and trend logs.

E. The base unit of the ASC shall host various I/O combinations including universal inputs, binary outputs, and switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.

F. All binary outputs shall have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. The position of each HOA switch shall be available system wide as a BACnet object.

G. Controller shall be capable of BACnet communication. BACnet Conformance:
   1. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.

H. Schedules: Each ASC shall support a minimum of 10 BACnet schedule objects.

I. Logging Capabilities: Each controller shall support a minimum of 100 trend logs. Sample time interval shall be adjustable at the operator's workstation. Controller shall periodically upload trended data to system server for long term archiving if desired. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

J. Alarm Generation: Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures. Alarm logs shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects -system destination and actions individually configurable.

2.6 UNITARY SYSTEM CONTROLLERS (USC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, cooling coil control valve control. The temperature sensor and the valve control signal.)

B. The EMCS Contractor shall provide all Unitary System Controllers. USCs shall be fully programmable or applications specific controllers with pre-packaged operating sequences maintained in Flash RAM.

C. The USC shall be a node on the automation network and shall control its own communications so that the failure of any one node, shall not inhibit communications on the network between the remaining nodes. USCs shall be totally independent of other network nodes for their monitoring and control functions.

D. Provide each USC with a battery back-up for the protection of volatile memory for a minimum of 72 hours. Batteries shall be rated for a seven-year life.

E. All associated applications programs shall reside at the USC. The USC shall not require communication to any other panel for normal operating sequences other than time scheduled base commands.

F. Control shall be based on algorithms, i.e. proportional plus integral plus derivative (PID), proportional plus integral (PI), or proportional to comply with the sequences of operation PID algorithms shall maintain the system operation within +/- 2% of setpoint.

G. The USC shall be configured with sufficient input/output capacity to achieve the required control points to meet the sequence of operations.

2.7 VAV TERMINAL UNIT CONTROLLER (TUC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, terminal unit air valve control. The flow sensor and the actuator control signal.)

B. The EMCS Contractor shall provide all controllers required for all variable air volume (VAV) terminal units. The number and location of terminal units and airflow rates shall be as indicated on the mechanical drawings.

C. The TUC shall be capable of monitoring and controlling the following parameters for VAV terminal units per the sequences of operation and input/output summary: space temperature; primary air flow rate; damper modulation; heating coil stage control, heating valve control, heating SCR control (as applicable); fan on/off control; supply air sensor; occupancy senor; carbon dioxide sensor or humidity sensor.

D. Furnish primary damper actuators, for factory mounting, meeting the following requirements: direct shaft mounting; adequate torque, to properly operate the damper from fully open to fully closed without binding; locking “V” groove or similar means to prevent slippage between actuator and shaft.

E. The EMCS Contractor shall field install the following components for each terminal unit: space temperature sensor; supply air temperature sensor; occupancy sensor, and carbon dioxide sensor as indicated on the Mechanical Drawings.

F. The EMCS Contractor shall furnish to the terminal unit manufacturer the following components for factory installation and wiring for each terminal unit: VAV controller with integral differential pressure transducer and damper actuator.

G. The terminal unit manufacturer may provide the following components for each terminal unit for interface and mounting of the TUC: primary air dampers; enclosure to house the TUC and associated components including suitable mounting brackets shall be NEMA 1 rating and located outside the terminal unit; multi-point averaging type flow sensor at the primary air inlet to the terminal unit; 24 VAC control transformer; 24 VAC fan control relay interface; 24 VAC heater control relay interface (up to two stages); 24 volt SCR heater input as scheduled (0-10 Vdc or 4-20 mA).

H. Any items required for proper operation but not provided by TU vendor, shall be provided under this section.

2.8 AIR HANDLING UNIT CONTROLLER

A. All devices required for single loop control shall be terminated on a single controller. (for example, AHU static pressure control. The differential pressure sensor and the VFD ramp signal.)

B. The EMCS Contractor shall provide controllers required for chilled/hot water and DX/electric heat air handling units and fan coil units. Provide an enclosure to house the controller and associated components including suitable mounting brackets shall be NEMA 1 rated and located outside the FCUs.

C. The controller shall be capable of monitoring and controlling the following parameters per the sequences of operation and input/output summary; space temperature; space relative humidity sensor; cooling/heating stage control or modulating valve control; fan on/off control and status; supply air sensor; occupancy sensor; carbon dioxide sensor; VFD control and monitoring.

2.9 EMCS CONTROLLER LEVEL NETWORK

A. EMCS Automation Level Network shall consist of BACnet MS/TP (76.8 Kbps minimum). Data transfer rate and data throughput as required to meet the alarm annunciation requirements.

2.10 SOFTWARE OVERVIEW

A. Dynamic Colored Floor plans: Dynamic colored floor plans that compare actual space conditions to setpoints shall be provided on all floorplan graphics displayed on the front-end. Floorplan enlargements shall also use the thermographs to display space conditions. Zones within the set point range shall appear transparent white. As the space gets warmer the zone color shall gradually modulate from transparent white to transparent red to identify a hot zone. As the space conditions get cooler the zone color shall gradually modulate from transparent white to transparent blue to identify a cold zone. Each zone shall indicate the current actual zone temperature within the zone. The floor plans shall use a dynamic scheduling icon to indicate schedule occupancy for each zone and provide direct one-click access to that zones unique schedule. Provide a designated icon or symbol indicating that the zone is in the occupied/unoccupied condition. From the floorplan graphic, the operator shall be able to click on any zone and go directly to the graphic for the piece of equipment controlling that zone. All dynamic floor plans shall be visible via web interface as well as on the LAN. The authorized system operator shall be able to change the zone or system identifier (or name) on the graphic and that change shall be distributed to other associated graphics and to the equipment controller.

B. All unitary graphics must have interactive graphics with animations. All relevant points shall be shown on graphic pages.

C. Pop up Trends: Provide trend logs that automatically pop up when the operator mouse clicks on the point from the graphic. Provide pop up trends for all dampers, control valves, temperature sensors, carbon dioxide sensors, humidity sensors, airflows, static pressures, flow meters, VFD speeds, etc. The EMCS contractor shall set up all trends for the owner. The pop-up trend shall include a trend tool that allows the operator to modify the trend time scale and sample interval for up to 10 sample values. The trends shall be graphical on the computer screen but shall provide an output as an .xls, .csv, .pdf, HTML, or text file.

D. Interactive Maps: Implement JAVA SCRIPT API 3.0 or newer, such as Google Interactive maps depicting the facility location to indicate the site plan. This is not a static image and must be completely interactive.

E. Custom User HTML applications: The EMCS shall utilize HTML applications as an extra feature. At minimum, provide 7-day forecast, weather radar, traffic map and hurricane tracker. All of these features shall be imbedded into the EMCS system.

F. Provided a web-based EMCS platform; contractor shall provide an Open License software. Licenses that are not open are not acceptable. There shall be no per seat or per user licensing fee charged to the owner by the contractor.

G. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms shall be BACnet Objects.

H. User access shall include 50 assigned operators that shall include five levels of access within the web system. Each operator log-in shall have an expiration date to allow for temporary access to the system. The operator's access description shall include his e-mail address and cell/phone numbers. The operator access can be limited from 5 minutes to permanent access. The user shall be limited to eight bad login attempts before being locked out of the system.

I. Global modification: Provide the capability for global modification of user definable parameters of all points shall be provided. Global modification is defined as the mass adjustment of user definable parameters across a defined group, area, facility, campus, or network. Parameters shall include, but not be limited to temperature set point (VAV boxes, AHU Discharge, VAV AHU Static Pressure Setpoints etc.), equipment start/stop, equipment status, valve output signal, VFD speed control signal, and damper position signal. User shall be able to lock the definable parameter to a set value, or adjust a set point to an operator adjustable value. This function shall be accomplished through the standard graphical user interface/workstation and is to be selectively applicable by the user to all controllers on the network, all controllers in a specific facility or all controllers in a specific zone within a specific facility.

J. The system operator shall be able to override the output signal to the valves, dampers, variable frequency drives, etc. with the use of the PC mouse click on the device. The system override shall include a Hand-Off-Auto (HOA) capability. If the output is commanded to the hand position the operator shall designate an output value of 0-100% in 1% increments. The hand override position shall be permanent or expire after a designated time period and revert to the auto position. The color-graphic shall indicate the device that has been overridden by a color change of the output value.

K. For non-emergency in-warranty events the system operator may submit a Service Request directly from the floor plan or system graphic. The web interface shall include the EMCS suppliers contact information including phone numbers and e-mail address. The service request will be logged into the EMCS suppliers service department. A non-response by the assigned technician shall elevate the request to the next highest manager or supervisor until the system operator receives an response that their request has been received and is scheduled for a resolution. All requests for service shall be maintained in the customer's database for future reference. The service request capability may be extended after the expiration of the warranty as part of a service agreement.

L. The web-based system shall be accessible from Tablet PCs and provide the same functionality that is available from personal computers connected through the LAN or WAN to the system operator. The tablet PCs as a minimum shall include an Apple iPad and Google Android based tablet PC. Operation shall include touch screen capability and use of the tablet keyboard screen. The operator shall be able to view color-graphics, system trends, override setpoints, change time schedules, and override damper and valve positions.

2.11 ENERGY SAVING PROGRAMS

A. Demand Limiting: Demand limiting programming and sequence shall include, but not be limited to the following:
   1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
   2. Integrate with lighting controls to reduce lighting power to an operator set maximum demand level.
   3. Provide a means from the graphical user interface for the system operator to manually initiate or disable the demand limiting sequence.
   4. Provide programming that will allow a demand response signal from an approved entity (electrical service provider) to remotely initiate or disable the demand limiting sequence.
   5. Provide programming that will initiate demand limiting according to a schedule.
   6. When demand limiting is initiated, the EMCS shall:

a. Increase the space cooling temperature setpoint by 4 degrees F (adj), above the current operating setpoint. The rate of change for the temperature setpoint increase shall be operator adjustable.

b. Decrease the space heating temperature setpoint by 4 degrees F (adj), below the current operating setpoint. The rate of change for the temperature setpoint decrease shall be operator adjustable.

c. Automatically reduce lighting power on the circuits indicated on construction documents.

7. When demand limiting is disabled, the EMCS shall reset temperature setpoints and lighting power levels back to original operating setpoints.
8. Demand limiting shall be confined to “non-critical” zones. For purposes of planning, assume all zones are “non-critical” unless otherwise noted on the construction documents. All zones shall have the option to be added or removed from the demand limiting program, by the system operator.
9. The EMCS shall include a graphic "page" that shows all adjusted setpoints (original setpoints and demand limited setpoints) and the power meters being monitored to confirm the programming is operational and effective at shedding the associated loads.

B. Duty Cycling: Periodically stop and start loads, based on space temperature, and according to various on/off patterns.

C. Automatic Time Scheduling: Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.

D. Optimal Start/Stop: Perform optimized start/stop as function of outside conditions, inside conditions, or both. Optimization shall be adaptive and self-tuning, adjusting to changing conditions by modifying occupancy period based upon the desired temperature at beginning and end of the occupancy period. Base optimization on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.

E. Night-Setback Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours in conjunction with scheduled start/stop and optimum start/stop programs.

F. Setpoint Reset: Setpoints for control of variable load systems shall be reset based on load demand, as described in the Sequence of Operations.

G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.

H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.

I. Holiday Scheduling

J. Direct Digital Control: Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.

K. Trend logging shall be provided for all points per the input/output summary where there is a change in the analog or binary signal. Each controller shall be capable of storing trend values and then automatically transfer data to the NAC or the NS hard disk. Trend data shall be updated continuously per the operator assigned interval at intervals as low as one minute. Collect samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs. Binary points (input and output) shall only be logged upon a change of value (COV). Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.12 FIELD INSTRUMENTATION

A. Temperature Sensors: All temperature sensors shall be thermistor type, factory-calibrated to within 0.5 °F, interchangeable with housing appropriate for application. Sensors shall have a temperature curve rated for the application. Sensor wiring terminations shall be in a galvanized box.
   1. Outside air temperature sensors shall be installed in weather proof enclosure with ventilated sun-shied.
   2. Duct mounted temperature sensors shall be averaging type for supply air, mixed air and low temperature applications for air handling units. Duct probe temperature sensor shall be acceptable for terminal units.
   3. Space temperature sensors shall contain a backlit LCD digital display and user function keys along with temperature sensor, setpoint adjustment and after-hours override use. Override time may be set in one-hour increments.
   4. Thermowell temperature sensors shall be stainless steel probe of length that is equivalent to a minimum of 50% of the pipe diameter. End-to-end accuracy shall be ± 0.5 deg. F. Connection box shall be moisture/water proof with conduit fitting. Furnish the stainless steel thermowell to the mechanical contractor for installation. A thermal conducting grease shall be installed in the thermowell to provide uniform temperature sensing.
   5. Provide flat plate stainless steel space temperature sensors with no local setpoint adjustment as indicated on the drawings.

B. Carbon Dioxide Sensors: The sensor shall be capable of monitoring carbon dioxide concentration with an accuracy of +/- 30 parts per million (PPM). The sensor shall produce a linear 0-10 VDC or 4-20 mA signal over the range of 0 to 2000 PPM. The sensor shall measure using non-dispersed infrared (NDIR) technology to measure carbon dioxide gas and shall be:
   1. Wall mounted carbon dioxide sensors shall be Veris CWE series or equivalent.
   2. Duct mounted carbon dioxide sensor shall be Veris CWD series or equivalent.
   3. The EMCS contractor shall utilize the required calibration devices to properly commission and calibrate the sensors per the manufacturer’s requirements.

C. Relative Humidity Sensors: relative humidity sensors shall be a two-wire type, 4-20 mA output proportional to the relative humidity range of 0-100%. The accuracy of the sensors shall be +/- 2% over a range of 10-90% RH.
   1. Outdoor relative humidity sensors: provide non-corroding outdoor shield to minimize wind effects and solar heating. Install wall-mount weather proof enclosure with conduit fitting. Sensor shall be Veris HO series, or equivalent.
   2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall-mounted enclosure with white cover. Sensor shall be Veris HEW series or equivalent.
   3. Duct-mounted relative humidity sensor: sensor shall be provided with a moisture resistant enclosure with conduit fitting. The probe length shall be 8” minimum. Sensor shall be Veris HED series or equivalent.

D. Pressure Transducers:
   1. Air pressure transducer: The pressure transducer shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 264 or equivalent. Air pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.
      a. Duct mounted pressure sensor shall be stainless steel and provided with mounting flange and hardware. The sensor probe length shall be appropriate for the associated duct dimensions.
      b. Wall mounted space pressure sensor shall include stainless steel wall plate, pressure pick up filter, and mounting hardware.

c. Ceiling mounted space pressure sensor shall be paintable, low-profile type, with pressure pick up filter, integral surge dampener, and adhesive ring for ceiling mount.

d. Outdoor pressure sensor shall include an outdoor rated sensor, 50 ft. of vinyl tubing, mounting bracket and hardware. A surge dampener shall also be provided for all outdoor pressure sensor applications to absorb pressure fluctuations.

2. Water pressure transducer: The pressure transducers shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 230 or equivalent. Transducer shall include a valved piping bypass and bleed off for each port. Water pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.

E. Freezestat: Provide freezestats for all chilled water air handling systems that receive more than 10% untreated outside air. Freezestats shall provide vapor tension elements, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in series, to provide one linear foot per square foot of coil surface area. Freezestat shall be manually reset at the switch. Interlock to the associated fan so that fan will shut down when HOA switch is in hand or auto position. Provide time delay relays with a 0-10 minute time delay relay duration to minimize nuisance freezestat trips. Time delay relay shall be adjustable at the associated control panel.

F. Air differential pressure switch: For fan shutdown, provide air differential pressure switches for all fans controlled by a variable frequency drive (VFD) to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall have an adjustable setpoint with a range of 0-10 inches w.g. with manual reset at the switch unless otherwise indicated to be automatic reset. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct. Sensor shall be DWYER Series 1900 or equivalent.

G. Momentary control relays: Provide momentary control relays as indicated. Relays shall have coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application. Contact ratings shall be 10 amp. Provide complete isolation between the control circuit and the digital output. Relays shall be located in the UC or other local enclosures and have pin-type terminals. Relays shall have LED indication of status.

H. Current sensing relay: Current sensing relays shall be rated for the applicable load. The output relay shall have an accessible trip adjustment over its complete operating range. Enclosure shall have an LED to indicate relay status.

I. Photocell: Ambient light level shall by a photocell in a non-corroding in a weatherproof housing with sun shield suitable for exterior installation. The control signal output shall be 4-20 ma or binary contact closure as specified in the sequences of operation. Mount the photocell on the north side of the building on the roof. The sensor reading shall be 0-750 foot-candles.

J. Occupancy Sensors

1. Occupancy sensors shall be dual-technology, ceiling mounted type. Sensors shall be capable of detecting presence in the control area by via Doppler shifts in transmitted ultrasound and passive infrared (PIR) heat changes. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off. The sensor shall operate at 24 VDC/VAC. WattStopper DT-300 or approved equal.
2. Sensors shall have a time delay that is adjustable with configuration software or shall have a fixed time delay of 5 to 30 minutes, set by a DIP switch. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

3. The sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options. The sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.

2.13 HVAC VENTILATION SHUTDOWN SWITCH

A. The HVAC ventilation shutdown switch shall be a mushroom type switch, STI Series 2000 Stopper Station that complies with the following:
   1. Color shall be coordinated with the Owner prior to ordering.
   2. Latches when depressed.
   3. Twist to reset.
   4. Indoor/Outdoor flush type clear plastic cover.
   5. Switch label shall read "HVAC VENTILATION SHUTDOWN" or other label approved by the Owner. Coordinate final label text with the Owner prior to ordering.

B. Coordinate final location of shutdown switch with the Mechanical Drawings, the Architect, and the Owner prior to installation.

2.14 WHOLE BUILDING METERING

A. Buildings are to monitor electrical, water and gas usage. Any additional sub metering is to be provided by the contractor and determined by each specific project as called out on the drawings or specifications.

2.15 WATER FLOW METERS

A. Insertion Electromagnetic Flow Meters shall be provided for HVAC metering and domestic water metering applications where indicated on mechanical drawings or in control diagrams in piping larger than 1 inch. The flow meter shall have a 316L stainless steel insertion probe with XAREC sensor head and weather-tight NEMA 4 electronics enclosure; +/- 1.0 % accuracy of actual reading from 2 to 20 ft/s and +/- 0.02 ft/s below 2 ft/s; flow range of 0.1 ft/s to 20 ft/s, turndown ratio of 200:1; pulse outputs proportional to flow rate. All wetted materials used in domestic water metering applications shall be NSF 61 and NSF 372 compliant. The flow meter shall be installed with a minimum of 10 diameters of straight pipe upstream and 5 diameters of straight pipe downstream. Refer to meter manufacturer's installation manual for additional straight pipe length requirements. Provide full port valve to allow for removal and re-insertion without disruption to the water service. Meters provided for HVAC applications shall be furnished and installed by Division 23. Meters provided for Domestic water applications shall be furnished by Division 23 and installed by Division 22. Meter shall be ONICON F-3500 series or pre-approved substitution. Domestic water flow meters shall be approved by the associated Municipal Utility District (MUD).

B. Inline Wetted Ultrasonic Flow Meters shall be provided for cooling tower make-up water metering and blow down metering applications in piping ranging from ½” to 2 ½”. The flow meter shall consist of a drop forged corrosion resistant metal flow body with process connections, integral transducers, transmitter with LCD display and user interface. All wetted materials shall be NSF 372 compliant; +/- 1.0 % accuracy of actual reading over a 25:1 turndown ratio; overall flow range turndown of 500:1; pulse and analog outputs proportional to flow rate and native BACnet MS/TP. Contractor shall provide a y-strainer upstream of each meter and isolation valves upstream and downstream of each meter. Placement of the flow meter must meet or exceed the manufacturer’s published placement requirements. Meters shall be furnished and installed by Division 23. Meter shall be ONICON F-4600 or pre-approved substitution. Cooling tower meters shall be approved by the associated Municipal Utility District (MUD).

2.16 WATER BTU METERING SYSTEMS

A. BTU metering systems shall be provided and calibrated by a single manufacturer and shall consist of a water flow meter, two temperature sensors, a BTU meter, temperature thermowells, and all other required installation hardware and accessories. All BTU metering system components shall be by ONICON or pre-approved substitution.
   1. The BTU meter shall be a high accuracy, microprocessor-based instrument that includes integral backlit LCD display, front panel interface, calculator accuracy of +/- 0.05 %, and 24 VAC input power connection. The meter enclosure shall be NEMA 13 when installed indoors and NEMA 4 when installed outdoors. The BTU meter shall provide the following points both at the integral LCD and as outputs to the energy management and control system: Energy Total, Energy Rate, Flow Rate, Supply Temperature and Return Temperature. All output signal data shall be communicated using BACnet® MS/TP or BACnet/IP. Each BTU meter shall be factory programmed for its specific application and shall be re-programmable using the front panel keypad without the use of any additional interface devices. BTU meter shall be ONICON SYSTEM-10 or pre-approved substitution.
   2. Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched for the specific temperature range for each application. The calculated differential temperature used in the energy calculation shall be accurate to within +/- 0.15˚F including the error from individual temperature sensors, sensor matching, input offsets, and calculations.
   3. The flow meter shall be the type as specified in this section for the application. The flow meter shall be installed in either the supply or return pipe of the system to be measured and follow manufacturer's installation requirements as specified in this section.

2.17 AIRFLOW MEASURING STATIONS (AFMS)

A. Duct mounted airflow measuring stations with combination airflow and air temperature measurement devices shall have the following features:
   1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of +/-0.15° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C) and shall be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be EBTRON, Inc. GTx116-PC.
   2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.
   3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of Reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s) and shall be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

2.18 DAMPERS

A. Provide motorized volume control and shutoff dampers as detailed in 23 33 00 - DUCTWORK ACCESSORIES.

2.19 DAMPER ACTUATORS

A. Outside and exhaust air damper actuators shall be mechanical spring return. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.

B. Outside and return air modulating actuators shall utilize analog (proportional) control 0-10 VDC. Actuators shall be driven in both the open and closed directions.

C. Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.

D. Single section dampers shall have one electronic actuator direct shaft mounted.

E. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.

F. Damper actuators shall be BELIMO or equivalent.

2.20 CONTROL VALVES

A. Furnish all valves controlled by the EMCS as shown on the Mechanical Drawings. Furnish all automated isolation valves as shown on the Mechanical Drawings. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. EMCS contractor to size control valve with a maximum of 3 psi pressure drop. 2-position isolation valves shall be full-line size.
   1. All chilled water, condenser water, and hot water valves shall meet, at minimum, the following ANSI Class 150 ratings. Valves 0.5 inch to 2 inches shall have NPT female screwed ends. Valves 2.5 inches and larger shall have flanged ends.
   2. Equal Percentage control characteristic shall be provided for all water coil control valves.

B. Pressure Independent Characterized Control Ball Valves ½” to 6”, for two-way modulating applications shall have equal percentage characteristics and control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI across the valve. The pressure independent control valve shall be provided and delivered from a single manufacturer as a complete assembly. The actuator shall be integrally mounted to the valve at the factory with a single screw on a direct coupled DIN mounting-base. All valve actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow and/or temperature control. Programming using actuator mounted switches or multi-turn actuators are not acceptable. The control valves shall be sized for the scheduled flow and not pressure drop. Calibrated Balancing Valves and Automatic Flow-Control Valves shall be prohibited from use at coil circuit piping where pressure independent control valves are installed. Contractor shall provide a section of straight pipe five times the pipe diameter with respect to the nominal valve size upstream of the control valve assembly where utilizing integral flow sensor to guarantee sensor accuracy.
   1. NPS 3/4” and Smaller: Belimo PIQCV or equal. Forged brass body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, characterizing disc integral to ball, PTFE ball seat, dual EPDM lubricated O-rings, and female NPT union ends. Close off pressure rating of 100 psi. Integral pressure regulator located upstream of ball to maintain a constant pressure differential. Replaceable cartridge type regulators are not permitted.

2. NPS 1” through 2”: Belimo ePIV or equal. Forged brass, nickel-plated body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, PTFE ball seat, dual EPDM lubricated O-rings, stainless steel or TEFZEL characterizing disc, and female NPT union ends. Close off pressure rating of 200 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.
3. NPS 2-1/2” through 6”: Belimo ePIV or equal. GG25 cast iron body according to ANSI 125, Class B, stainless steel ball and blowout-proof stem, PTFE ball seat, with a dual EPDM lubricated O-rings and a stainless steel flow characterizing disc. End connection pattern to match ANSI 125 flange. Close off pressure rating of 100 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.

C. Characterized Control Ball Valves (CCV) for ½’ to 2”: for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo or approved equal.
   1. Valve housing shall consist of forged brass rated at no less than 400 psi at 250 °F. Three-way valves shall have EPDM O-rings behind ball seals to allow for a minimum close-off pressure of 40 psi with an actuator that provides 35 in-lbs torque for ½ to 2 in. sizes. Three-way valves shall be installed in a “tee” configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

D. Globe Valves 2-1/2” to 6”: for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo G7 series or approved equal.
   1. Valve housing shall consist of cast iron rated at no less than 125 psi at 300 °F. Valve shall have stainless steel stem, plug and seat. Three-way valves shall be installed in a “tee” configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

E. Butterfly valves: For chiller and cooling tower isolation control valves, butterfly control valves may be provided.
   1. Butterfly Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats. Butterfly valves shall have ductile iron body, 304 stainless steel disc and EPDM seat. The valve body close-off pressure rating shall be 150 psi over a range of -20 F to 250 F. The flange shall be ANSI 125/250. Provide Belimo Series F6 and F7 or Bray Series 3L.

F. Actuators for characterized control valves and globe valves: Provide electric actuators for all control valves that are furnished as part of the EMCS contract. Two-way and three- way control valve actuators shall meet, at minimum, the following requirements:
   1. Motor driven type with gear assembly made of hardened steel. Actuator shall have an input voltage of 24 VAC. Provide visual mechanical position indication.
   2. Actuators installed within the interior of the building envelope shall be provided with NEMA-2 rated housings.
   3. Actuators installed exterior to the building envelope shall be provided with NEMA-4 rated housings or a weather shield. All penetrations through exterior actuator housings shall be provided with fittings that prevent water ingress.
   4. Valves shall be sized to meet the shut-off requirements when operating at the maximum system differential pressure and with the installed system pump operating at shut-off head. Actuators shall control against system maximum working pressures.
   5. Normal and failure positions shall be as indicated in the operating sequences. Provide spring return action per the sequences.
   6. Manual declutch lever to enable manual operation of the valve. It shall be possible for an operator to manually modulate valves located in mechanical rooms in the event of loss of power.

7. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.
8. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.
9. Electric actuators shall be Belimo, compatible with the valves furnished.

G. Butterfly Valve Industrial Actuators
1. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.
2. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1 phase, 60 Hz supply. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
3. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
4. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
5. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.
6. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All analog valves shall be positive positioning, and respond to a 2-10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.
7. Butterfly valve actuators shall be Belimo furnished with specified butterfly valves.

2.21 REFRIGERANT LEAK DETECTION

A. Refrigerant leak detection monitors shall be provided for the refrigerant and number of chillers installed.
1. Power consumption: AC - 325 mA, DC - 250 mA. Volt free contacts to indicate an alarm condition.
2. Operating temperature range of 32 °F to 105 °F. Operating humidity range of 0 to 95% non-condensing.
3. Measuring range of 0-1000 ppm proportional to 4 to 20mA output range for each sampling point.
4. System shall detect the presence of the types of refrigerants provided with the chillers using sequential sampling and multi-point monitoring method.

5. System shall annunciate to the EMCS through a contact closure and have a local alarm (audible and visual) Control panel shall have a silencing alarm button. Initial alarm shall comply with recommended Allowable Exposure Level (AEL). Adjustable 3 level alarm for each point shall be supplied with common alarm output contacts. Provide local digital indication of ppm level for a minimum of 1 sample point per chiller. A sample point shall be located close to each chiller and the refrigerant pump out unit location. Location to be approved by the engineer. Sample point if in alarm shall flash the associated LED. Provide local alarm horns and visual (stroboscopic) beacons at the following locations to activate upon alarm to an approved detail:
    a. Outside of entrance doors to chiller machine room.
    b. Inside rooms without an escape route other than through the chiller room.
    c. At each chiller location.
    d. At any other location in the chiller room as necessary to ensure that a person at any location in the chiller room and room that can be entered from the chiller room can see the visual alarm and hear the audible alarm and at any other location required to meet the applicable codes.
6. Emergency signs shall be provided in accordance with NFPA 704. Signs shall include a warning that the visual and audible alarms indicate a refrigerant leak has been detected and the monitored area should be evacuated. Sign material shall be engraved, laminated, UV resistant plastic or etched metal with self-adhesive backing. Submittals shall include sign material, dimensions, color, lettering format, and warning message for approval. Emergency signs shall be installed outside each exit door to monitored rooms. Install signs near alarms located at exits where they can be easily seen. Coordinate final locations with the Architect and Owner prior to installation.
7. System shall shut down all electrical equipment (chiller systems and associated pumps, AHU, FCU, etc.) and sequence emergency extract equipment as required to meet regulations. Where combustion equipment is employed, refrigerant vapor monitoring system shall automatically shut down the combustion process in event of refrigerant leakage if other alternative acceptable conditions are not applied. Ventilation system, chiller and associated pumps and other equipment shut down as a result of the refrigerant leak alarm shall return to normal operation when the refrigerant monitoring system is no longer detecting refrigerant levels above set points and alarms have been silenced.
8. System shall have self-diagnostics and supply common malfunction output. Loss of sample flow at either sample or ZERO line and electrical malfunction shall annunciate to the EMCS.
9. Provide two (2) additional particulate filters and zero gas filter cartridges.
10. Provide an emergency shut-off control button outside each chiller plant room entrance/exit door. Button shall be mounted at 48 inches above finished floor adjacent to refrigerant leak detection alarm light. Activation of any one of the buttons shall de-energize all chillers and other electrical equipment within the chiller plant room. Button shall be manually reset.
11. Provide BACnet MS/TP interface to EMCS. Provide Strobe/Horns and Emergency Push Buttons.
12. Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.
13. Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
    a. Be capable of supplying all equipment used to check or calibrate the unit
    b. Be capable of providing onsite service with factory trained personnel
    c. Be capable of providing start-up assistance and training for the owner/operator
14. Refer to section 23 09 53 for further information.

2.22 PANELS AND ENCLOSURES

A. Provide panels and enclosures for all components of the EMCS, which are susceptible to physical or environmental damage.

B. Interior panels and enclosures shall meet be NEMA 1 rated painted steel panels with locking door.

C. Exterior mounted panels and enclosures shall be NEMA 4 painted steel panels with locking door.

D. Panels for USCs shall be mounted on the outside of all unit ventilators and fan coil units with three feet of wall clearance in front of them and no higher than 7 feet to the bottom of the panel.

2.23 LABELING AND WARNING NOTICES

A. Provide labeling for all control panels and enclosures.

B. Provide labeling of all control wires and input/output points at the controller and at the control device; the label at each end of the wire shall be the same Labels shall be machine generated, typed and clearly legible with a maximum of 17 characters. Hand written labels or labels written on the control wire jacket will not be acceptable. Each label shall be unique to its function and shall reference the applicable system. For example “AHU-1 SAT” will indicate the supply air temperature sensor for AHU-1. Improper labeling shall be removed and shall require re-commissioning of the control device and controller to document correct functionality.

C. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.

D. Phenolic label on the front of panel to indicate name of control panel and also indicate what equipment is controlled from panel.

2.24 TUBING AND PIPING

A. Provide tubing and piping as required for the field instrumentation.

B. Tubing within equipment rooms, vertical risers, and penetrations to ductwork shall be either copper pipe or shall be plastic tubing within conduit. Tubing for all water-based instrumentation shall be copper pipe. Identify the type of tubing proposed in the shop drawing submittal.

C. Provide suitable bulk head fittings for duct and panel penetrations.

D. Tubing in plenum rated areas may be plastic tubing. Polyethylene tubing shall meet, at minimum, the following requirements: flame retardant; crack resistant; 300 psi burst pressure.

2.25 CONDUIT AND FITTINGS

A. Provide all conduits, raceways and fittings for the EMCS monitoring, communication and control cabling. All work shall meet all applicable codes.

B. Conduit, where required, shall meet, the requirements specified within Division 26.

C. EMCS monitoring and control cable shall not share conduit with cable carrying voltages in excess of 90 VAC.

D. Conduit and fittings must be rated for exterior/outdoor conditions.

E. Provide PVC coated conduits for all exterior conduits serving cooling tower.

2.26 CABLING

A. Provide all cables for the EMCS. Cable shall meet, at minimum, the following requirements:
   1. Minimum 98% conductivity stranded copper.
   2. Proper impedance for the application as recommended by the EMCS component manufacturer.
   3. Monitoring and control cable shall be #18 AWG or larger, dependent on the application. Analog input and output cabling shall be shielded.
   4. Management Level Network cable shall be CAT 6, 24 gauge unshielded.
   5. Automation Level Network cable shall be #24 AWG shielded.
   6. Shield shall be grounded at the CCP, UC, or control panel. Ground at one end only to avoid ground loops.
   7. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.

B. 120 VAC power wiring shall be of #12 AWG solid conductor or larger as required.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION

A. The EMCS supplier shall provide a pre-construction coordination meeting with the affected trades to ensure a cooperative efficient process of installation. The invited trades shall include the general contractor, mechanical contractor, electrical contractor, test and balance contractor, commissioning provider, owner’s representative, consulting engineer and others with a direct interest in the coordination of the affected systems. The EMCS contractor shall provide an outline of the meeting agenda highlighting the construction schedule, coordination with mechanical and electrical trades. Provide a sign-in sheet and submit it through the attendees along with a summary of the meeting notes for future reference.

3.2 INSPECTION DURING INSTALLATION

A. Provide a technician to assist the Engineer or Owner’s Representative with inspections made during the installation period that are required to review the progress and quality of ongoing work. The engineer/owner’s representative shall generate field observation reports on the findings of the inspection. The engineer or owner’s representative shall advise the EMCS contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The EMCS contractor shall take corrective action to meet the requirements of the specifications. Upon correction, the EMCS contractor shall submit written documentation through the contractors to the engineer.

3.3 INSTALLATION OF COMPONENTS

A. Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with specification Division 26 and all national, state and local electrical codes.

B. Provide wire and wiring techniques recommended by equipment manufacturers. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in. Provide auxiliary pilot duty relays on motor starters as required for control function.

C. Electrical Contractor shall provide 120 or 277 volt power at a junction box within 48” of the controller. The BAS Contractor shall coordinate with the Electrical Contractor to identify locations of power requirements prior to the installation of the controls.

D. Conduit for control wiring shall be provided whenever one of the following conditions exists:
   1. Conduit is indicated on the drawings or specifically required by the specifications.
   2. Cabling runs through inaccessible areas such as within partitions/walls, above closed in ceilings, under floor; within trenches and underground; on the exterior of the building; exposed on the surface of the building; when encased in concrete or other material that makes the cable inaccessible or when located such that access to the cable is not readily obtained.
   3. Cable within mechanical, telecommunications and electrical equipment rooms and control rooms.
   4. Conduit shall be installed, inside wall from sensor box to above the wall, for all wall mounted temperature, humidity and CO2 sensors.

E. Control wiring located above an accessible ceiling space may be plenum rated cable. Plenum rated wire shall be bundled and routed at right angles to the building lines and secured to the building structure every 15 feet.

F. Control wiring located in underground conduits shall be provided with direct-burial-rated insulation.

G. When communication bus enters or exits a building, a surge suppressor shall be installed. The surge suppressor shall be installed according to the controls manufacturer’s instructions.

H. Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof.

I. All sensor wiring shall be labeled to indicate the origination (at the device) and destination of data (at the control panel). The description shall indicate the type and location of the control device such as “AHU-1 SA temp” or “VAV 1-1 space temp”.

J. Wall temp sensors at 48” above the finished floor to comply with ADA requirements and to match the height of the light switches. Mount humidity sensor at equal height to wall temperature sensor.

K. Outdoor pressure sensors shall be installed a minimum of five feet above the roof surface and shall be free of immediate obstructions and sources of turbulence that could affect pressure readings. Sensors shall be attached to the top of roof mounted equipment or provided with stand-alone vertical support if no roof mounted equipment is available. Sensor tubing shall be routed into the building through a sealed weathertight penetration. Provide a heat trap loop in the sensor tubing immediately below the roof.

3.4 VERIFICATION REQUIREMENTS

A. Verification shall be provided by the EMCS contractor to demonstrate and confirm that the installed system complies with the specifications and the control sequences of operation herein specified. upon completion of the verification process the EMCS contractor shall demonstrate to the engineer or owner’s representative the functionality of the control system devices are in compliance with the contract documents.

B. Technicians provided by the EMCS contractor shall be factory trained and qualified in the operation of the provided control system. The EMCS contractor shall provide, if requested, the factory training certificates of the individuals providing the verification services on this project.

C. Verification tools, applicable to the system provided, shall be utilized by the factory-trained technicians for proper verification of system operation and functionality. Temperature verification sensors shall be NIST certified within the last 12 months. Meters such as Fluke 52 series or better shall be utilized. Use of non-certified meters may require the system to be re-verified with certified meters at no cost to the owner.

D. Documentation of the verification process shall be provided per the project general conditions in electronic PDF format as required. Documentation shall include the following forms:
   1. Project System Verification Forms for each controller provided on the project to verify the proper function of each controller, control device and system component provided.
   2. Panel Verification Forms for each control panel to document the proper installation and function of each control panel provided.
   3. Sequence of Operation Verification Forms for each piece of controlled equipment to confirm compliance of the control system with the specified sequences of operation.
   4. Not providing proper documentation for each control devices, panel, or system, upon request by the engineer or owner's representative, may require the EMCS contractor to re-verify the applicable systems at no additional cost to the owner.

E. After completion of the verification, the EMCS contractor shall be able to demonstrate the sequence of operations for each system to the engineer and the owner's representative.

F. Equipment checkout sheets are to be produced by this contractor showing checkboxes and compliance with the following procedures for each piece of equipment and turned over to the owner and/or mechanical engineer.

3.5 COLORGRAPHICS

A. The colorgraphics shall be provided for the EMCS system prior to system acceptance and owner training.

B. The colorgraphics provided shall include the following as a template. Provide forward and backward links on the graphic.
   1. Site plan with link to overall building plan including detached buildings. The site plan shall be referenced to an automatically updated aerial view or map view of the area such as Google Maps or Bing Maps. Provide link to proceed to the overall building floor plan.
   2. The overall building plan shall indicate space temperature conditions referenced by the color of the zone. Specific details of the zone temperatures and equipment are not required. Provide a link to the floor plan wings, upper floors and remote buildings.
   3. The floor plan colorgraphics shall indicate the space temperatures by color references. Additional information shall indicate the space temperature, the occupancy of the zone, air handling units, VAV terminals and ductwork with diffusers. A link at each terminal unit or AHU shall automatically connect the system operator to the equipment colorgraphic.
   4. The colorgraphics for the equipment shall as a minimum be equal to the points from the input/output summary or control schematic. Primary control devices as required by the sequences of operation shall also be provided.
   5. Control points from equipment that are integrated into the EMCS via BACnet shall be provided to convey the operating conditions of the attached equipment. Coordination of the integration points shall be accomplished during the submittal phase. The EMCS contractor shall provide a list of all integrated points on their submittal.

3.6 ENERGY MONITORING PROGRAMMING AND GRAPHICS

A. The EMCS shall be programmed to include a dedicated graphics page for energy monitoring.

B. The kW and kWH data acquired from each power meter shall be categorized within the EMCS by the following end-uses.
   1. Total HVAC system loads

2. Interior lighting loads
3. Exterior lighting loads
4. Plug loads
5. Process loads
6. Building operations and other miscellaneous loads

C. The EMCS shall provide a graphic representation to show instantaneous real-time energy consumption data and shall provide hourly, daily, monthly, and yearly energy consumption data. Where multiple meters are used to measure an end-use category, the graphic representation for that end-use category shall include data from the individual meters as well as a total for the associated category. The graphic representation shall also include time and date of the highest peak demand for the current month and year as well as prior months and years for stored data. Demand thresholds may be set to adjust and shed loads in order to reduce peak consumption.

D. All meter data collected shall be stored for a minimum of 36 months and shall have the ability to be trended by building operation and management personnel on an hourly, daily, monthly, and yearly basis using the previous 36 months of stored data.

3.7 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Startup testing documentation: Prepare the checklist documenting startup testing of each input and output device, with technician's initials and date certifying each device has been tested and calibrated prior to acceptance testing. This document shall indicate proof that the following functions have been commissioned and shall be included in the as-built documentation: short to ground check, configuration of trends, confirmation that color-graphics are accurately representing actual systems, point to point checkout, all damper and valve actuators respond to input change, control modules are addressed and have functional descriptors, specified interlocks are functional, calibration report of all sensors, discrete outputs respond to time schedule or manual enable command.

B. Demonstration. Prior to acceptance, demonstrate the following performance tests to demonstrate system operation and compliance with specifications.
1. Engineer, owner’s representative and mechanical contractor shall be invited to observe and review system demonstration. Provide attendees at least 10 days notice.
2. Demonstration shall follow process approved as part of the submittal and shall include complete checklists and forms for each system as part of system demonstration.
3. Demonstrate actual field operation of each sequence of operation as specified. Demonstrate calibration and response of any input and output points requested by engineer or owner’s representative.
4. Demonstrate complete operation of operator interface including review of color-graphics, time schedules, trend logs, alarm notification, functionality of tablet PC operation.
    a. PID loop response. Supply graphical trend data output showing each PID loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be selectable from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values.
    b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand limiting setpoint, and status of set points and other affected equipment parameters.
    c. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs.

5. Alarms and Interlocks. Check each alarm with an appropriate signal at a value that will trip the alarm. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction. Alarm verification shall include temperatures exceeding alarm threshold (high and low), fan failure safety, duct high static pressure switch, freezestat, and smoke detector shutdown.
6. Tests that fail to demonstrate proper system operation to the engineer shall be repeated after contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

C. Owner Acceptance.
1. After tests described in this specification are performed to the satisfaction of both engineer and owner’s representative, the engineer shall accept the control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond EMCS contractor's control. Engineer shall provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved by the engineer.

3.8 DEMONSTRATION AND OWNER TRAINING

A. Furnish basic operator training for multiple persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 16 hours: 8 hours instructor time for onsite training and 8 hours of hands on class environment training. Training sessions may be provided in 4-hour increments as approved by the owner’s representative.
1. Change/modify temperature setpoints.
2. Change/modify time of day, holiday and override schedules.
3. Display, create, and modify trends of system points.
4. Update room numbers on the color-graphics.

B. Demonstrate complete and operating system to Owner. Provide written documentation listing the attendees of the specified training with sign-in sheet and training time and date.

3.9 SEQUENCE OF OPERATIONS

A. Refer to the Mechanical Drawings for project control schematics and sequence of operations.

END OF SECTION

SECTION 23 21 13 - ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe and pipe fittings.

B. Flanges, unions, dielectric connections, and couplings

C. Valves.

D. Heating water piping system.

E. Chilled water piping system.

F. Condenser water piping system.

G. Condensate drain piping.

1.3 RELATED WORK

A. Section 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

B. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

C. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

D. Section 23 05 53 - Identification for HVAC Piping and Equipment

E. Section 23 07 19 - HVAC Piping Insulation

F. Section 23 21 16 - Underground Hydronic Piping

G. Section 23 21 19 - Hydronic Specialties

1.4 REFERENCES

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

E. ASME B31.1 - Power Piping; 2024.

F. ASME B31.3 - Process Piping; 2024.

G. ASME B31.9 - Building Services Piping; 2020.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

I. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

K. ASTM B32 - Standard Specification for Solder Metal; 2020.

L. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

N. ASTM D1384 - Standard Test Method for Corrosion Test for Engine Coolants in Glassware; 2005.

O. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

P. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. ISO 9001 - Quality Management Systems — Requirements; 2015.

S. ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

T. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

U. ASTM B32 - Solder Metal.

V. ASTM B88 - Seamless Copper Water Tube.

1.5 QUALITY ASSURANCE

A. Foreign made pipes and fittings will not be acceptable.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder’s Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include data on pipe materials, pipe fittings, valves, and accessories.

C. Include welder’s certification of compliance with ASME BPVC-IX.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Deliver and store valves in shipping containers with labeling in place.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, proper storage and dunnage, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.1 CHILLED AND HEATING WATER AND GLYCOL PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black.
   1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type fittings.
   2. Joints: Threaded, or AWS D1.1/D1.1M, welded.

2.2 CONDENSER WATER PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black
   1. Fittings: ASME B16.3, black malleable iron or ASTM A234/A234M, galvanized forged steel welding type.
   2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized.
   1. Fittings: Galvanized cast iron, or ASME B16.3 malleable iron.
   2. Joints: Threaded, or grooved mechanical couplings.

B. Copper Drainage Tubing: ASTM B306, DWV.
   1. Fittings: ASME B16.23 cast copper alloy solder joint DWV fittings or ASME B16.29 wrought copper alloy solder joint DWV fittings.
   2. Joints: Soldered joints made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn50/Pb50 solder.

2.4 FLANGES, UNIONS, DIELECTRIC CONNECTIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under: Provide 150 psi malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 Inches: Provide 150 psi forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/16 inch thick preformed neoprene bonded gasket.

C. Dielectric connections for pipe sizes 2 inches and under: Provide dielectric unions, rated at 180°F at 250 psi in compliance with ASSE 1079.

D. Dielectric connections for pipe sizes larger than 2 inches: Provide dielectric flanged pipe fittings, rated to 180°F at 175 psi in compliance with ASME B16.1.

E. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer, and conform to local code approval and/or is listed by ASME B31.1, ASME B31.3, ASME B31.9, ASME, UL/ULC. FM, IAPMO or BOCA. Grooved end manufacturer to be ISO 9001 certified. Grooved couplings shall meet the requirements of ASTM F1476. Manufacturer shall be Victaulic, Anvil Gruvlok, or Shurjoint. Can be utilized only in mechanical rooms or cooling tower areas.

2.5 ACCEPTABLE MANUFACTURERS - VALVES

A. Milwaukee

B. Crane

C. Nibco

D. Apollo
E. Bray
F. Kitz

2.6 ACCEPTABLE MANUFACTURERS - VALVES (GROOVED ONLY)

A. Victaulic
B. Anvil Gruvlok
C. Shurjoint

2.7 GATE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.
B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.8 GLOBE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable stainless steel disc, threaded ends, with back seating capacity.
B. Over 2 Inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.9 BALL VALVES

A. Up to 2 Inches: Bronze two-piece body, 600 PSI full port, stainless steel ball and stem, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends.
B. Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive hand wheel for sizes 10 inches (250 mm) and over, flanged.
C. Ball valves installed in insulated lines shall have stem extensions compatible with up to 2” of insulation. Extensions shall be non-metallic equal to Nibco “nib-seal”.

2.10 BUTTERFLY VALVES

A. Iron body, aluminum bronze or stainless steel disc, resilient replaceable seat for service to 180 degrees F lug or grooved ends, extended neck, infinite position lever handle with memory stop. Valve shall be rated at full working pressure with downstream flange removed in either direction.

2.11 SWING CHECK VALVES

A. Up to 2 Inches: Bronze 45 degree swing disc, threaded ends.
B. Over 2 Inches Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged or grooved ends.

2.12 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, stainless steel spring, aluminum bronze disc, threaded, grooved, wafer or flanged ends.

2.13 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. After completion, fill, clean, and treat systems.
E. Provide extended necks for all vents, thermometer wells, pressure gauge wells, pet cocks and pete's plugs.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
B. Install piping to conserve building space, and not interfere with use of space and other work.
C. Group piping whenever practical at common elevations.
D. Branch tap connections to piping mains shall be from the top of the pipe.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING.
F. Provide clearance for installation of insulation, and access to valves and fittings.
G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.
H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
J. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09.
K. Install valves with stems upright or horizontal, not inverted.
L. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer.
M. Grooved manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and the product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.
N. All valves located above ceiling shall be installed within 18" of the bottom of the ceiling assembly to permit access to the valves.
O. Provide an engraved label attached to ceiling grid labeled "VL" to indicate valve locations above ceiling. Label shall be engraved laminated plastic with 1/4 inch high letters, black text manufactured by Seton Company or approved equal. Label shall be placed directly below valve location.

P. Provide wall mounted laminated floor plans in central plant showing valve locations for the entire floor. Provide separate laminated sheets for each floor of the building.

3.3 APPLICATION

A. Use grooved mechanical couplings and fasteners only in mechanical rooms or cooling tower area.

B. Install unions downstream of valves, and at equipment or apparatus connections.

C. Provide non-conducting dielectric connections wherever joining dissimilar metals.

D. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

E. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Install plug valves for throttling, bypass, or manual flow control services.

G. Provide spring loaded check valves on discharge of condenser and chilled water pumps.

H. Use only butterfly valves in condenser water systems for throttling and isolation service.

I. Use lug end butterfly valves to isolate equipment.

J. Provide chain operated butterfly valve for installations at 12 feet or higher.

K. Provide 3/4-inch ball (drain) valves equal to Nibco T-585-70-HC at main shut-off valves, low points of piping, bases of vertical risers, and at equipment and pipe to nearest drain.

L. Provide automatic air vents at all high points and air pockets in the system. Where automatic air vents are installed above a ceiling or in other concealed locations, provide vent tubing to nearest drain.

M. Provide manual air vents as indicated on details and drawings.

N. Plug type gauge cocks shall not be allowed. Provide ball valves for gauge isolation applications.

3.4 CONDENSATE DRAIN PIPING

A. Drain piping from each unit shall be extended to the nearest floor drain or condensate drainage system. Drains shall be of the size indicated but not less than the full size of the drain pan connections.

B. Use plugged tees in lieu of elbows.

C. Slope all drain lines 1/8" per foot, minimum.

D. Provide auxiliary drain pan on all AHU's above ceiling with auxiliary drain line routed to discharge in visually prominent area. Discharge location shall be coordinated with Architect.

3.5 PIPE FABRICATION AND INSTALLATION

A. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.

B. Piping layout and installation shall be made in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance from other work. Particular attention shall be given to piping in the vicinity of equipment; layout shall be made in such manner as to preserve maximum access to the various equipment parts for maintenance.

C. All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

D. Air vents and air chambers shall be installed as hereinafter specified.

3.6 OFFSETS AND FITTINGS

A. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate structural and finish conditions affecting the Work, and shall take such steps as may be required to meet such conditions at no additional cost to the Owner.

B. All piping shall be installed close to walls, ceilings and columns, (consistent with the proper space for covering, removal of pipe and special clearances), so as to occupy the minimum of space, and all offsets, fittings, etc., required shall be provided at no additional cost to the Owner.

3.7 SECURING AND SUPPORTING

A. All piping shall be adequately supported to line and grade, with due provisions for expansion and contraction.

B. Piping shall be supported on approved clevis type, split ring, or trapeze type hangers properly connected to the structural members of the building.

C. All insulated piping shall be fitted with suitable steel protection saddles.

D. Perforated bar hangers, straps, wire or chains will not be permitted.

3.8 ISOLATION VALVES

A. All piping systems shall be provided with line size shut-off valves located at risers, at branch connections to mains, and at other locations as indicated and required.

3.9 TESTING OF PIPING SYSTEMS

A. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Engineer. The Engineer or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of any insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 48 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.10 PIPE CLEANING, FLUSHING AND PURGING REQUIREMENTS AND PROCEDURES

A. The hydronic system shall be flushed and purged by contractor:
   1. All mains, branches and zones shall be cleaned and treated per steps indicated below.
   2. Owner/Engineer shall be given 72-hour notice prior to each step being performed.

B. Pre-flush requirements: Purpose is to get system ready for flushing and purging:
   1. Piping must pass all required pressure testing and visual inspection for leaks.
   2. All pumps shall be tested for rotation and properly aligned and lubricated.
   3. Chemicals planning on being used must have certificate of assurance and product cut sheets presented to the owner/engineer prior to being used. All chemicals must be approved by the state prior to being added to the system, FDA approved and meet ASTM D1384. Automotive grade chemicals are not allowed.
   4. Bypass all coils and heat exchangers by connecting the supply and return piping together.
   5. Fill entire system with clean fresh potable water.

C. The flush requirements: Purpose is to completely remove all debris, dirt and air from hydronic system.
   1. Add system cleaner that contains detergent and emulsifying agents to properly remove grease, grime and other debris for steel pipe. Volume of cleaner used shall be about 10% of total volume.
   2. System shall be circulated for a minimum of 48 hours with water velocities of a minimum of 5 ft/sec or greater. After completed all strainers shall be removed and cleaned thoroughly. House pumps are acceptable to circulate water. House pumps or pump seals that are damaged during the flushing process shall be replaced at no cost to the Owner.
   3. The system shall be entirely drained and flushed out to remove all of the cleaner from the system as quickly as possible after cleaning to prevent debris from settling. All strainers shall be removed and thoroughly cleaned after no more dirt and cleaner is visible in the flushing water as it leaves the system.

D. Final fill:
   1. All air vents shall be opened to allow air to escape during filling.
   2. Reconnect all flex connections to equipment.
   3. System shall be drained and filled with a local domestic/softened water mixture as required by chemical treatment supplier. System shall be filled with pressure reducing valve at the specified fill pressure.

E. Purging: Purpose is to remove all air from the system:
   1. System shall be circulated for a minimum of one hour with water velocities of a minimum of 5 ft/sec or greater until all visible air is removed.

F. Final chemical addition: Purpose is to install chemicals during inhibitor as required:
   1. After the above final fill and purging has been completed and accepted by the engineer/owner the final chemical addition can be done.

2. Chemical treatment shall be added to the system after thoroughly mixing water per the manufacturer's recommendations. Chemical treatment shall include inhibitors. Quantities and concentrations of inhibitor/chemicals should be applied per the manufacturer's specifications and approval submittals.
3. System water shall be tested for chemical inhibitor concentrations, reserve alkalinity and PH. Reports shall be submitted to engineer/owner.
4. All records and documentation shall be kept and given to the owner upon completion.

END OF SECTION

SECTION 23 21 19 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Expansion tanks.

B. Volume tanks.

C. Air vents.

D. Air separators.

E. Strainers.

F. Pump suction fittings.

G. Flow indicators, controls, meters.

H. Radiator valves.

I. Relief valves.

J. Pressure and temperature test plugs.

1.3 RELATED SECTIONS

A. Section 23 21 13 - Above Ground Hydronic Piping

B. Section 23 21 16 - Underground Hydronic Piping

C. Section 23 21 23 - HYDRONIC PUMPS

D. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

1.4 REFERENCES

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

B. Conform to ASME BPVC-VIII-1 for manufacturer of tanks.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.8 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - EXPANSION TANKS

A. Bell and Gossett.

B. TACO.

C. Wessels Co.

D. John Wood

2.2 COMPRESSION TYPE EXPANSION TANKS

A. Construction: Closed, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 125 psi rating; cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.

B. Gage Glass Set: Brass compression stops, guard, and 3/4 inch red line glass, maximum 24 inches length, long enough to cover tank for 2 inches above bottom to 2 inches below top.

C. Quick Connect Air Inlet: Automotive tire valve type, manual air vent, tank drain, and pressure relief valve.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

E. Hot Water Heating System: Set expansion tank pressure relief valve at 20 psi maximum and pressure reducing valve at 12 psi.

F. Chilled Water System: Set expansion tank pressure relief valve at 25 psi maximum and pressure reducing valve at 12 psi.

2.3 BLADDER TYPE EXPANSION TANKS

A. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, prime coated, with replaceable heavy duty butyl bladder, and steel base. The tank bladder shall allow for full acceptance of the expansion tank volume.

B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.4 ACCEPTABLE MANUFACTURERS - CHILLED WATER VOLUME TANKS

A. TACO.
B. Wessels Co.
C. John Wood.
D. Reco.

2.5 CHILLED WATER VOLUME TANKS

A. Construction: Carbon steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with internal baffle, exterior painted primer finish, and steel base ring or angle legs.
B. Accessories: Tank vent and drain; flanged inlet and outlet connections; 1” thick flexible, elastomeric thermal insulation, Armaflex AP or equal.

2.6 ACCEPTABLE MANUFACTURERS - AIR VENTS

A. Armstrong.
B. Bell and Gossett/ITT Hoffman.
C. IMI Flow Design.

2.7 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
B. Float Type: Brass or semi-steel body, copper float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
C. Washer Type: Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.8 ACCEPTABLE MANUFACTURERS - AIR SEPARATORS

A. Bell and Gossett.
B. Thrush.
C. TACO.
D. Spirotherm

2.9 AIR SEPARATORS

A. Dip Tube Fitting: For 125 psig operating pressure; to prevent free air from rising into system.
B. Air Elimination Valve: Bronze, float operated, for 125 psig operating pressure.
C. Combination Air/Dirt Separators: Steel, tested and stamped in accordance with ASME BPVC-VIII-1, for 150 psig operating pressure, with air elimination valve, internal coalescing medium, inline inlet and outlet connections, and bottom drain connection with isolation ball valve.

2.10 ACCEPTABLE MANUFACTURERS - STRAINERS

A. Armstrong.
B. Bell and Gossett.
C. IMI Flow Design.
D. Mueller Steam Specialty.

2.11 ACCEPTABLE MANUFACTURERS - STRAINERS (GROOVED ONLY)

A. Victaulic
B. Anvil Gruvlok
C. Shurjoint

2.12 STRAINERS

A. Size 2 inch and Under: Threaded brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
B. Size 2-1/2 inch to 4 inch: Flanged or grooved iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
C. Size 6 inch and Larger: Flanged or grooved iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.13 ACCEPTABLE MANUFACTURERS - PUMP SUCTION FITTINGS

A. Bell and Gossett.
B. TACO.

2.14 ACCEPTABLE MANUFACTURERS - PUMP SUCTION FITTINGS (GROOVED ONLY)

A. Victaulic
B. Anvil Gruvlok
C. Shurjoint

2.15 PUMP SUCTION FITTINGS

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged or grooved for 2-1/2 inch and larger, rated for 175 psig working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.
B. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.16 ACCEPTABLE MANUFACTURERS - FLOW INDICATORS

A. Bell and Gossett.
B. Watson McDaniel.

2.17 FLOW INDICATORS

A. Brass construction, threaded for insertion into piping system, packless, with paddle with removable segments, vapor proof electrical compartment with switches.

2.18 ACCEPTABLE MANUFACTURERS - FLOW CONTROLS

A. Bell and Gossett/ITT Hoffman.

B. IMI Flow Design.

C. TACO.

D. Victaulic/TA

2.19 FLOW CONTROLS

A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet, and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

D. Accessories: In-line strainer on inlet, and ball valve on outlet.

2.20 ACCEPTABLE MANUFACTURERS - FLOW METERS

A. Bell and Gossett/ITT Hoffman.

B. IMI Flow Design.

C. TACO.

D. Victaulic/TA.

2.21 FLOW METERS

A. Orifice principle by-pass circuit with direct reading gauge, soldered, or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.

B. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check valves with gasketed caps.

C. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

D. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

E. Portable meter consisting of case containing two, 3 percent accuracy pressure gauges with 0-135 inches and 0-60 feet pressure ranges for 500 psig maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

2.22 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

A. Bell and Gossett.
B. McDonnell-Miller.
C. TACO.

2.23 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.24 ACCEPTABLE MANUFACTURERS - PRESSURE AND TEMPERATURE TEST PLUGS

A. Peterson Equipment Company

2.25 PRESSURE AND TEMPERATURE TEST PLUGS

A. Test plugs shall be designed to receive temperature or pressure probe. Plugs shall be solid brass with two valve cores of Neoprene (Max 200°F service), fitted with removable protective cap, cap retaining strap, and gasket. Provide plugs with extension neck to match pipe insulation thickness.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer`s instructions to permit intended performance.
B. Support tanks inside building from building structure in accordance with manufacturer`s instructions.
C. Where large air quantities can accumulate, provide enlarged air collection standpipes.
D. Provide automatic air vents at all high points and air pockets in the system. Where automatic air vents are installed above a ceiling or in other concealed locations, provide vent tubing to nearest drain.
E. Provide manual air vents as indicated on details and drawings.
F. Provide air separator on suction side of system circulation pump and connect to expansion tank.
G. Provide valved drain and hose connection on strainer blow down connection.
H. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
I. Support pump fittings with floor mounted pipe and flange supports.
J. Provide relief valves on pressure tanks; and on low pressure side of reducing valves, heat exchangers, and expansion tanks.
K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
L. Pipe relief valve outlet to nearest floor drain.

M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

N. Provide pressure and temperature test plugs at the inlet and outlet of all coils, coil control valves, heat exchangers, strainers, pumps, and at all other locations indicated on the drawings.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. In-line circulators.

B. Vertical in-line pumps.

C. Close coupled pumps.

D. Base mounted pumps.

1.3 RELATED SECTIONS

A. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

B. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

C. Section 23 07 16 - HVAC EQUIPMENT INSULATION

D. Section 23 07 19 - HVAC Piping Insulation

E. Section 23 21 16 - Underground Hydronic Piping

1.4 REFERENCES

A. NEMA MG 1 - Motors and Generators; 2021.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum five years' experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

C. Impellers: All impellers shall be dynamically balanced.

D. The Mechanical Contractor shall be responsible for accurately checking all pumping heads, based upon the actual piping and equipment installation. The Contractor shall be responsible for furnishing pumps and motors of proper sizes suitable for the actual installation. Do not provide pumps with capacities less than the amount indicated on the Drawings.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

C. Submit manufacturer's installation instructions under provisions of Division One.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.9 EXTRA PARTS

A. Provide one set of replacement mechanical seals for each size of pump. After the pumps are in operation for ninety days, the Contractor shall check the seals and replace any that are defective. If the replacement seals are not used during the 90-day operational period, they shall be delivered to the Owner.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Taco.

B. Aurora.

C. Bell and Gossett.

D. Armstrong

E. Grundfos/Paco.

2.2 GENERAL CONSTRUCTION REQUIREMENTS

A. Balance: Rotating parts, statically and dynamically.

B. Construction: To permit servicing without breaking piping or motor connections.

C. Pump Motors: NEMA MG 1 motors shall operate at 1750 rpm unless specified otherwise. Provide totally enclosed motors when mounted outdoors. Refer to Section 23 05 13.

D. Pump Connections: Flanged, for pipe size two inches and larger. Provide union for pipe sizes less than two inches.

E. Critical speed of each pump shall be at least 115% of the running speed listed in the schedule.

F. Pumps shall meet the minimum quality standards of UL 778.

2.3 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psig maximum working pressure.

B. Casing: Cast iron.

C. Impeller: Brass or bronze, keyed to shaft.

D. Bearings: Two, oil lubricated bronze sleeves.

E. Shaft: Stainless steel with stainless steel sleeve, integral thrust collar.

F. Seal: Carbon rotating against a stationary ceramic seat viton fitted, 275 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

2.4 VERTICAL IN-LINE PUMPS

A. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psig maximum working pressure.

B. Casing: Cast steel, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

D. Shaft: Stainless Steel or Steel with Stainless Steel Sleeve.

E. Seal: Carbon rotating against a stationary ceramic seat viton fitted, 225 degrees F maximum continuous operating temperature.

2.5 CLOSE COUPLED PUMPS

A. Type: Horizontal shaft, single stage, close coupled, radially split casing, for 125 psig maximum working pressure.

B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze or Stainless Steel, fully enclosed, keyed to motor shaft extension.

D. Shaft: Stainless steel.

E. Seal: Carbon rotating against a stationary ceramic seat, viton fitted, 225 degrees F maximum continuous operating temperature.

2.6 BASE MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, back pull-out, radially or horizontally split casing, for 175 psig maximum working pressure.

B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze or Stainless Steel, fully enclosed, keyed to shaft.

D. Bearings: Grease or Permanently lubricated roller or ball bearings, 40,000 hour minimum life.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Carbon rotating against a stationary ceramic seat, viton fitted 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible drop-out coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim or pan.

I. For pumps driven by motors 25 horsepower and larger, the steel base shall be fabricated of structural shapes and formed steel sections. The main structural member and formed steel section shall have a depth of at least 1/12 the overall length of the base but not less than 4 inches. The base shall be filled with concrete or grout after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

D. Pumps shall be free of flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.

E. The impeller selected for compliance with design requirements shall not exceed 95% of cutwater diameter for the selected pump casing size. This shall be clearly certified on the Shop Drawing submittal.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge lines.

G. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and shut-off valve on pump discharge.

H. Provide air cock and drain connection on horizontal pump casings.

I. Provide drains for bases and seals, piped to and discharging into floor drains.

J. Lubricate pumps before start-up.

K. Install base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place.

L. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers; 2013 (Reapproved 2014).

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

D. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024.

E. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems; 2019, with Addendum (2024).

F. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

J. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

L. AWS B2.2/B2.2M - Specification for Brazing Procedure and Performance Qualification; 2016.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

B. Piping: Submit data on pipe materials, fittings, and accessories.

C. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

D. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes.

E. Welding Certificates: Submit per AWS B2.2/B2.2M and ASME BPVC-IX.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide for the systems as shown. Submit shop drawings of piping systems showing all traps, pipe sizes, and accessories; drawing to be marked "Approved" and signed by a representative of the Application Engineering Department of the condensing unit manufacturer. Pipe sizes shall be as recommended by unit manufacturer. Refer to piping schematic on Drawings.

2.2 MATERIAL

A. PIPE: Type ACR copper tubing, hard-drawn, per ASTM B280.

B. FITTINGS: Wrought copper per ASME B16.22.

C. JOINTS: Brazed joints with Sil-Fos filler metal per AWS A5.8M/A5.8.

2.3 ACCESSORIES

A. All accessories shall be UL listed and rated in accordance with AHRI 710.

B. On systems 7-1/2 tons and larger, each separate refrigerant circuit shall have a separate filter drier rated in accordance with AHRI 730 (I-P). Each filter drier shall have a replaceable core and a three valve bypass. The filter drier shall be full line size and installed in the refrigerant liquid line. The filter shall have a minimum 4-3/4 inches diameter shell with removable flange and gasket. Flange shall be tapped for 1/4 inch FPT access valve. Size filter-drier for maximum 2.0 psi pressure drop at evaporator operating temperature. Similar to Mueller Refrigeration model Drymaster micro-guard refillable filter series SD-485 through SD19217 or Sporlan catch-all.

C. On systems less than 7-1/2 tons, the filter drier shall be the sealed type; sizes as above. One drier per refrigerant circuit.

D. Liquid-Moisture Indicator shall be full line size, installed in liquid refrigerant line. Indicator shall be rated for the applicable refrigerant, system pressure and temperature; manufactured by Mueller Refrigeration or Sporlan.

E. Thermostatic expansion valve shall have adjustable super heat and be as manufactured by Sporlan.

F. Shut-off valves shall be bi-directional ball valves with welded body, brass ball with dual Teflon seals and integral relief port. Valves shall be rated for the applicable refrigerant, system pressure and temperature. Valves shall be manufactured by Mueller Refrigeration or Sporlan.

2.4 REFRIGERANT AND OIL

A. Contractor shall leave the refrigeration system with a full charge of refrigerant and oil and shall be responsible for the maintenance of a full charge of refrigerant and oil in the systems for a period of one year from date of Substantial Completion.

B. Should any leaks in the refrigeration system occur during the guarantee period, the Contractor shall eliminate such leaks and recharge system to a full charge of refrigerant and oil at no cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment and piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

C. Refrigerant piping shall be installed in accordance with ASHRAE Std 15 and ASHRAE Std 34.

D. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

E. Braze joints per AWS B2.2/B2.2M and AWS A5.8M/A5.8 requirements.

F. Pipe shall be cut square, reamed and chamfered, and shall be free from burrs and obstruction. Pipe ends shall have full-bore openings and shall not be undercut.

G. Refrigerant piping located in areas other than the room or space where the refrigerating equipment is located shall be identified with pipe markers that meet labeling requirements of ASME A13.1. Markers shall be manufactured by W.H. Brady Company or approved equal. The pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: "DANGER – Risk of Fire or Explosion. Flammable Refrigerant." For any Group B refrigerant, the identification shall also include the following statement: "DANGER – Toxic Refrigerant".

H. Refrigerant piping routed indoors shall be installed at a minimum of 7'-3" above finished floor when located above an area affording passage of occupants.

I. Refrigerant piping located indoors shall be located within building elements such as a ceiling or wall space or within a protective enclosure unless installed a minimum of 7'-3" above finished floor, within 6'-0" of the associated equipment or within a refrigerant machinery room.

J. Provide shield plates for refrigerant pipes containing Group A2L and B2L refrigerants that are located in concealed locations where piping is installed in studs, joists, rafters or similar member spaces, and are located less than 1-1/2 inches from the nearest edge of the member. Shield plates shall have a minimum thickness of 16 gage and shall extend two inches beyond the edge of the piping on each side.

K. Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.

3.2 FIELD QUALITY CONTROL

A. Test piping and refrigeration system in accordance with ASME B31.5, ASHRAE Std 147, and this section.

B. The refrigerant piping system shall be tested as a whole or separate tests shall be conducted for the low-pressure side and high-pressure side of the piping system.
   1. Pressure Test:
      a. Pressure test shall be performed using dry nitrogen.

b. The means used to pressurize the refrigerant piping system shall have on its outlet side a test pressure measuring device and either a pressure-limiting device or a pressure-reducing device. The test pressure measuring device shall have an accuracy of +/- 3% or less of the test pressure and shall have a resolution of 5% or less of the test pressure.

c. The system shall be pressurized for a period of not less than 60 minutes. Additional test gas shall not be added to the system after the start of the test.

d. Test pressure shall be at least 110% of the system design pressure.

e. Test pressure shall not exceed 130% of the design pressure of any component in the system.

f. The system shall not show loss of pressure on the on the test measuring device throughout the entirety of the test.

2. Evacuation and Leak Test:

a. Evacuate moisture completely by applying a commercial vacuum pump. Moisture indicator shall indicate a completely moisture-free condition at time of final inspection.

b. The vacuum pump shall run until the system indicates a vacuum of 500 microns.

c. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise for a minimum of 24 hours.

d. The system shall be flushed with the operating refrigerant and the vacuum pump connected and rerun to repeat the evacuation. Evaluation shall be performed under supervision of the Engineer.

C. Repair any and all leaks and retest as required.

END OF SECTION

SECTION 23 25 13 - WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. ASTM D596 - Standard Guide for Reporting Results of Analysis of Water; 2018.

B. ASTM D1067 - Standard Test Methods for Acidity or Alkalinity of Water; 2016.

C. ASTM D1068 - Standard Test Methods for Iron in Water; 2015.

D. ASTM D1126 - Standard Test Method for Hardness in Water; 2017.

E. ASTM D3370 - Standard Practices for Sampling Water from Flowing Process Streams; 2018.

1.4 DESCRIPTION OF WORK

A. Work Included:Perform water analysis and provide all water treatment products, equipment and labor for testing, cleaning, flushing and dispensing products to control water quality for each system specified hereinafter as follows:
   1. Chilled Water System
   2. Hot Water System
   3. Closed Circuit Condenser Water System

B. Chemicals: Provide, at no additional cost to the Owner, all chemicals required for operating and testing all water treatment systems prior to and for one (1) year after Substantial Completion.

C. Instructions: Provide operating and maintenance instructions for each water treatment system; include one set in each Owner's Manual and deliver one set to Owner's operating personnel.

D. Testing Equipment and Reagents: Furnish suitable water treatment testing equipment for each system, complete with apparatus and reagents necessary for operation prior to and for three (3) months after Substantial Completion.
   1. Service Representative:
      a. Cleaning and Flushing test required verifying satisfactory completion of pipe cleaning.
      b. Provide water analysis report quarterly on each operating system.
      c. Annually perform microbiological culture study on the system to monitor bacteria.

E. Replacement and Rework: Replace defective or nonconforming materials and equipment with new materials and equipment at no additional cost to Owner for one (1) year after Substantial Completion; monthly reports shall be provided to the Owner and Architect/Engineer.
   1. Guarantee:Provide system produced by manufacturer who is willing to execute the required guarantee.

a. Agreement to Maintain:Provide system produced by manufacturer who is willing to execute (with the Owner) the required agreement for continued maintenance of the system.

1.5 QUALITY ASSURANCE

A. Qualifications: The Water Treatment Contractor for work under this Section shall have:
   1. Research and development facilities.
      a. Regional laboratories capable of making a water analysis.
      b. A service department and qualified technical service representative located within a reasonable distance of the project site.
      c. Service representatives who are Registered Engineers or factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system manufacturer. A Certified Water Technologist (CWT) qualified professional is preferred.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Chemical Standards: Provide chemical products acceptable under state and local pollution control or other governing regulations.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D596 for reporting. Indicate the ASTM best methods for each test. Tests will included by are not limited to conductivity, pH, chemical residual, iron, copper, and bacteria count.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, pumps, piping and tubing sizes, fittings, accessories, valves and connections and monitoring equipment.

C. Guarantee: Submit written guarantee, signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required to achieve the required performance, during a one (1) year period following the final start-up or the continued operation of the systems.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the water treating system shall submit four (4) copies of an "Agreement for Continued Service and the Owner's Possible Acceptance." Offer terms and conditions for furnishing chemical and providing continued testing and equipment for a one (1) year period with option for renewal of the Agreement by Owner.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
      a. Principle of how the equipment works.

b. Important parts and assemblies.
c. How the equipment achieves its purpose and necessary operating conditions.
d. Most likely failure modes, causes and corrections.
e. On site demonstration.

PART 2 - PRODUCTS

2.1 GENERAL

A. Water Analysis: Determine which chemicals to use from the results of a water sample analysis taken from the building site by the system manufacturer. Provide ingredients necessary to achieve the desired water conditions.
B. Pre-Treatment: Treat water piping systems with chemicals to remove and permit flushing of mill scale, oil, grease and other foreign matter.
C. FDA and USDA Approval: Use only FDA and USDA approved products in system with direct connection to domestic water systems.
D. Governing Laws: Ensure that neither products, waste, blow-down nor other effluents violate local, state, EPA, or other agency regulations in effect in the project area.

2.2 APPROVED WATER TREATMENT SERVICE

A. Water Treatment Services
B. Kurita (U.S. Water/ChemCal)
C. Chem Treat
D. Nalco
E. Garratt Callahan

2.3 CHILLED AND HOT WATER SYSTEMS

A. Chemicals: Provide water treatment products which contain inhibitors that perform the following:
1. Form a protective film to prevent corrosion and scale formation;
2. Scavenge oxygen and protect against scale;
3. Remain stable throughout operating temperature range, and;
4. Are compatible with pump seals and other elements in the system.
5. Corrosion inhibitor chemical – chill loop. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in CHILL LOOP water: 1) nitrite (as NO2) = 400-800 ppm, 2) borate = 200-400 ppm, 3) azole = 20-60 ppm. The resulting bulk water pH range should be 9.0-10.5.
6. Corrosion inhibitor chemical – hot loop. This product must impart the following active ingredients at the following dosages when fed in HOT LOOP water: 1) nitrite (as NO2) = 800-1200 ppm, 2) borate = 400-600 ppm, 3) azole = 40-80 ppm. The resulting bulk water pH range should be 9.0-10.5., for aluminum condensing boiler molybdate at 10 to 25 ppm.

B. Equipment: For each system, provide a 5-gallon filter feeder constructed of materials which are impervious to the products dispensed. Feeder shall be designed for not less than 200-psig operating pressure. Filter feeder shall be as manufactured by Vector Industries model FA-900 or approved equal. Provide flow indicator meter on discharge of filter feeder.

C. Test Kit: Provide test kit and reagents for determining proper water conditions. Test kit should be capable of testing presence of corrosion inhibitor and pH. A handheld connectivity/TDS meter shall be part of the test kit package.

D. Treatment: Treat initial water charge to water system, after system has been flushed and prepped, to achieve a water quality as specified. Test report required to verify cleaning.

E. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standard, where applicable:
   1. ASTM D1067 – Tests for Acidity or Alkalinity of Water.
   2. ASTM D1068 – Tests for Iron in Water and Waste Water.
   3. ASTM D1126 – Tests for Hardness in Water.
   4. ASTM D3370 – Sampling Water.

PART 3 – EXECUTION

3.1 THE WATER TREATMENT CONTRACTOR

A. General: After piping systems are erected pressure tested and proven free of leaks, administer chemicals required for preparation treatment and flushing. Apply chemicals for the time period and in the concentration recommended by the water treatment manufacturer for this portion of the work. Flushing must be for a minimum of 24 continuous hours.

B. Testing:After completion of 24 continuous hours of flushing, perform test procedures and submit a written report of test conditions and results to the Engineer. If test results are unsatisfactory, repeat preparation treatment as necessary to achieve test results approved by the Owner’s insurance carrier and the Engineer.

3.2 SERVICES OF MECHANICAL CONTRACTOR

A. Piping systems shall be pressure tested and approved for tightness, they shall be thoroughly cleaned and flushed using and approved pipe cleaning.

B. After initial chemical treatment has been added, the systems must be circulated for 48 hours with all valves opened; then the automated building system can be initiated.

3.3 PIPE CLEANING, STERILIZATION, AND FLUSHING

A. Additions/Renovations: When connecting new piping to existing piping, provide full size isolation valves at connection points and wire strainer with fine mesh screens.

B. All connections required for cleaning, purging and circulating shall be included as permanent installation with valves. Provide permanent pipe bypasses at each coil and heat exchanger during this cleaning operation and for future flushing. All air vents, gauges, strainers, etc., valved connections in piping systems shall be blown clean during cleaning and after cleaning operation is completed.

C. After cleaning, drain the system, fill with fresh water and flush thoroughly for a minimum of 48 hours or as recommended by Engineer.

D. All flushing, cleaning, and initial chemical treatment shall be complete and witnessed by Owner prior to starting systems.

E. Start-up procedures: During water system start-up, operate water treating system (after changing with specified chemicals) to maintain the required steady-state characteristics of water. Demonstrate system operation to Owner’s operating personnel.

3.4 ADDITIONAL REQUIREMENTS FOR THE WATER TREATMENT CONTRACTOR

A. Vendor shall warrant the chemicals used in the water treatment program, and will have no detrimental effects on the metallic or non-metallic materials in the equipment being treated; if applied according to Vendor's instructions.

B. All testing of the Owner's systems are to be completed on-site and discussed with Owner's HVAC personnel with a copy of the report given to him/her for signature.

C. All work shall be performed in cooperation with Owner's HVAC personnel.

D. Periodic de-scaling with inhibited acids will not be considered as meeting this specification.

E. Sulfuric acid or other inhibited acids shall not be used in the chemical treatment program of Owner.

F. The Contractor shall provide a biocide program consisting of both an oxidizing biocide and bio-dispersant if required.

3.5 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of heating water, chilled water treating systems. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

B. Provide two (2) hours in use and operation of water treating systems.

END OF SECTION

SECTION 23 25 16 - WATER TREATMENT FOR OPEN LOOP HYDRONIC SYSTEMS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Provide all equipment, chemicals, and treatment materials for the complete water treatment system.

B. Determine which chemicals to use for the results of a water sample analysis taken from the building domestic water supply.

C. Provide all water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for the cooling tower condenser water system.

1.3 REFERENCES

A. ASTM D596 - Standard Guide for Reporting Results of Analysis of Water; 2018.

B. ASTM D1067 - Standard Test Methods for Acidity or Alkalinity of Water; 2016.

C. ASTM D1068 - Standard Test Methods for Iron in Water; 2015.

D. ASTM D1126 - Standard Test Method for Hardness in Water; 2017.

1.4 SERVICE AND SUPPLIES

A. All work shall be performed by a qualified full-time water program manager.
   1. Specialist in the field of industrial water treatment.
   2. Facilities including water analysis laboratory, development facilities and service department.

B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride, and chemical residual) for field use.
   1. Reagents as required, suitable for specific use with the treatment products employs.

C. Where specialized supplementary testing or control equipment is required, the appropriate items shall be provided.

D. Provide a water management and service program for a period of one (1) year beginning at substantial completion of mechanical contractor’s scope of work.
   1. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
   2. Provide a water analysis report on each operating system.
   3. Analysis should include, but is not limited to:
      a. Corrosion inhibitor and/or organophosphate level to determine chemical residual value.
      b. Specific conductance in micro-ohms.
      c. pH

d. Iron and/or copper
e. Sodium chloride
f. Calcium hardness
g. Methyl alkalinity

4. A system free of excess biomass and tube scale is required. Contractor warranty to cover restoring system to clean condition (if necessary) is required. Owner will clean the cooling tower and brush the condenser tubes annually.

E. Routine Services
1. Check and adjust water treatment system operation.
2. Specify chemical value limits with proposal. MSDS pages required on all products used.
3. Adjust chemical pump and/or panel during each visit to maintain supplier's pre-determined values. A minimum of four (4) cycles of water is required.
4. Instruct, train, and advise operating personnel.
5. Check efficiency of chemicals and chemical applications.
6. Maintain present chemical feed system, parts, and labor. Or, supply a chemical feed system at no cost that is appropriate for the size of the system, operating conditions, and water chemistry values.
7. Twice per year, perform a microbiological culture study on all systems.

F. Chemically clean the piping system. If galvanized piping is used, cleaning chemical and operating treatment chemicals cannot exceed a pH of 9.0.

G. Provide a complete laboratory analysis of water samples.

H. Provide review of report figures in the field water testing.

I. Provide report charts and log sheets, and reorder charts for maintenance of water control tests.

J. Establish the recommended maintenance schedule for analysis and replenishment of the corrosion inhibitors.

1.5 QUALITY ASSURANCE

A. Quality: The contractor for the work specified in this Section shall have:
1. Research and development facilities.
2. Regional laboratories capable of making water analysis.
3. A service department and qualified technical service representative located within a reasonable distance of the project site.
4. A Certified Water Technologist (CWT) professional qualification is preferred. Service representatives who are Registered Engineers of factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system manufacturer are acceptable.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Ensure that neither products, waste, blow-down, nor other effluents violate local, state, or federal laws or regulations in effect.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D596 for reporting. Indicate the ASTM best methods for each test. Tests will included by are not limited to conductivity, pH, chemical residual, iron, copper, and bacteria count.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, pumps, piping and tubing sizes, fittings, accessories, valves and connections and monitoring equipment.

C. Guarantee: Submit written guarantee, signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required to achieve the required performance, during a one (1) year period following the final start-up or the continued operation of the systems.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the water treating system shall submit four (4) copies of an “Agreement for Continued Service and the Owner’s Possible Acceptance.” Offer terms and conditions for furnishing chemical and providing continued testing and equipment for a one (1) year period with option for renewal of the Agreement by Owner.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Water Treatment Services

B. Kurita (U.S. Water/ChemCal)

C. Chem Treat

D. Garratt-Callahan

E. Nalco

2.2 CONDENSER WATER SYSTEM

A. INTERNET WATER TREATMENT DATABASE
   1. Contractor must provide, configure, and support an Internet-accessible database account for the retrieving, recording, and archiving of water treatment related information. Such a system must have the following features:
      a. Secure, password-protected access for each manager and their chosen operators.
      b. Access to the system from anywhere via the Internet.

c. Zero software requirements (Internet browser required for user).

d. Ability for facility operators to record routine test log data online.

e. Ability for facility director and operators to upload pertinent digital images and PDF files.

f. Retrieve service reports, operator logs, laboratory analysis, corrosion coupon reports, inventory, digital images, MSDSs, product data sheets, technical papers, procedures, surveys, and training information.

g. Graphing and trending capabilities for any recorded service report and/or facility operator test data entries.

h. Ability of database system to routinely accept data (i.e., conductivity, ORP, pH, inhibitor, tank level sensor readings) electronically from the facility's water treatment controller(s).

i. Graphing and trending capabilities that compare entries of wet test data with controller sensor data.

j. Ability to set alarm limits and assign recipients for email alarm notifications for chosen test variables of service report and/or operator log entries.

k. Multiple security levels for various users.

l. Contractor training and in-services on use and navigation of the database system.

B. INTERNET-ACCESSIBLE WATER TREATMENT CONTROLLER

1. Contractor must provide, install, program, and support Internet-accessible water treatment controllers (i.e., eController, PLC, Hydro Triton) for condenser water treatment control. Such control equipment must have the following features:

a. Secure, password-protected access for each facility director and their chosen operators.

b. Access to the controller from anywhere via the Internet (facility dedicated phone line with service or public IP address mandatory).

c. Secure, password-protected access at controller unit keypad.

d. Daily status reports emailed to chosen recipients.

e. = Seven (7) 110 volt NO/NC relays, plus one (1) for alarms.

f. = Eight (8) 4-20 mA inputs.

g. = Six (6) digital inputs.

h. Ability to assign any input to any output online.

i. Output = (4) 4-20 mA signals.

j. Cellular modem built in or peripheral with one (1) year of cellular service for remote communication for remote alarming and data feed.

k. Industrial grade pH, ORP, corrosion, inhibitor, and conductivity sensors and housing as required per facility and system type.

l. Ability to read the make-up and blowdown water meters to determine evaporation credits.

m. Ability to record chemical tank level sensor data.

n. Ability to feed oxidizing biocide base on ORP set point(s) and record ORP of condenser water for any given period.

o. Ability of controller to routinely send data (i.e., conductivity, ORP, pH, inhibitor, tank level sensor readings) electronically to the facility's water treatment Internet database system.

p. Ability to review controller data trend charts.

q. Real-time availability of controller data.

r. Execution of controller changes (i.e., set points, dead bands, etc.) via the Internet.

s. Detailed email alarm notifications to chosen recipients.

t. UBS and Ethernet direct connect access.

u. Contractor training and in-services on use and navigation of the controller and its database system.

C. CHEMICAL FEED AND STORAGE EQUIPMENT

1. Contractor must have the ability to deliver and transfer chemical products to chemical storage tanks at each facility while minimizing the use of drums and pails. Contractor delivery technicians must be Hazmat trained and licensed truck drivers.

a. Contractor must provide, install, and support all relevant chemical feed and storage equipment necessary to treat the condenser water systems. The following water treatment equipment items must be installed and supported by the contractor:

b. Chemical storage tanks (i.e., Peabody, Snyder, GTP) with 110% containment. Tanks may come in a variety of sizes appropriate relative to the plants calculated chemical demand and have injection pump standpipe and vent line, as well as chemical fill point attachments.

c. Injection pump containment boxes (i.e., Stahlin) which are splash proof. Boxes shall be wall mounted above and near their related storage tank. Boxes must have sensor capable of interlocking injection pumps with leak detection.

d. Internet-accessible water treatment controllers (see Section above).

e. Industrial grade pH, ORP, and conductivity probes/sensors.

f. Industrial grade inhibitor monitoring probe (i.e., Turner) to ensure proper dosage of scale and corrosion inhibitor chemical.

g. Chemical injection pumps (i.e., Iwaki, Prominent) with controllable speed and stroke.

h. Storage tank level sensors (i.e., Flowline) which can be read by the controller.

i. Rotameter (i.e., King) for bypass loop piping.

j. Two (2)-pass corrosion coupon rack constructed of clear PVC.

k. Blowdown solenoid valve or motorized ball-valve (i.e., Parker, Belimo, or similar).

l. One (1)-inch schedule 80 PVC for bypass loop construction.

m. Chemical tubing containment from storage tank to pump box and from pump box to injection point. Materials of construction shall be 1 ¼-inch clear vinyl hose secured with stainless steel hose clamps shall be installed over all plastic chemical tubing for containment purposes.

n. Stainless steel chemical tubing (i.e., Swagelok or similar) where applicable (i.e., acid if used).

o. Contractor startup, training, and in-services on all provided equipment.

D. CHEMICALS - CONDENSER WATER

1. Contractor must select, manufacture, deliver, and transfer to storage tank chemicals capable of inhibiting and controlling mineral scale, corrosion, microorganisms, and biological fouling (i.e., biofilm) on all water-side surfaces (i.e., cooling tower fill, basin, piping, condenser tubes) of the condenser water system. Chemical supply will be for one (1) year past Date of Substantial Completion.
2. The microbiocide program must be consistent with CTI (Cooling Technology Institute) and or AWT (Association of Water Technologies) guidelines relative to the control of condenser water pathogens such as Legionella.
3. Contractor must be able to control the condenser water at a minimum of four (4) cycles of concentration while maintaining a Ryznar Stability Index (RSI) between 4.0 and 4.8. If this cannot be accomplished naturally based on the make-up water characteristics, the use of pH control with acid is acceptable.
    a. Scale and corrosion inhibitor chemical. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in condenser water: 1) phosphonate = 3-7 ppm, 2) AA copolymer = 4-10 ppm, 3) maleic acid (or) acrylate homopolymer = 4-10 ppm, 4) azole = 2-4 ppm, and 5) PTSA dye.
    b. Oxidizing microbiocide chemical. This product must be in the form of liquid sodium hypochlorite, chlorine dioxide, or liquid bromine. The use of oxidizer “tablets” is prohibited. This product must convey the following water test results during and shortly after feeding: 1) free oxidant = 0.1-0.5 ppm, 2) total oxidant = 0.4-1.0 ppm. This product must be fed in a manner to hold these residuals continuously using the ORP sensor feature of the controller.
    c. Antifoulant/dispersant “OR” non-oxidizing microbiocide chemical. The antifoulant / dispersant product must be in liquid form and be fed at a rate consistent with the recommendations in its product literature a minimum of one (1) time per week during low load periods. The non-oxidizing microbiocide shall be either isothiazolin or glutaraldehyde and be compatible with all other chemicals fed into the system. The non-oxidizing biocide shall be a broad-spectrum biocide effective at alkaline pHs. The product shall be capable of being handled and administered safely to the systems by operating personnel. Carbamate and other highly toxic microbiocides are prohibited. The non-oxidizing biocide shall be fed on a weekly basis to achieve a lethal dosage for the time necessary to provide effective control of microorganisms.
    d. Acid (OPTIONAL). This product must be in liquid sulfuric acid form if implemented. This product is to be part of the program ONLY if pH control is necessary to operate the condenser water at the desired 4 cycles of concentration minimum and 4.0-4.8 RSI. This product must be fed at a rate so as not to lower condenser water pH below 8.3 at any time. The dead band for the control of pH cannot be any more than 0.1 pH units. The pH set point will be chosen by the contractor based on make-up water characteristics, but no less than 8.3.

E. OPEARTOR TEST KIT
1. Contractor must select, prepare, and deliver a relevant test kit and components for operator’s use for operator testing. Test kit must come in a carrying case for ease of handling and contain testing procedures, log sheets, and reagent MSDSs. The contractor must provide a minimum of one (1) hour in-service to operators involved in routine testing. The contractor will replenish reagents at no charge for the one (1) year term.
2. Contractor must provide one (1) handheld fluorometer with single channel PTSA (i.e., Turner) for measuring condenser water scale and corrosion inhibitor dosage.
3. If acid (pH control) is used in the condenser water program, a hand-held conductivity/pH meter (i.e., Myron L 6-P) must be included in the test kit. Otherwise, a simple conductivity meter (i.e., Myron L EP-10) must be included in the test kit.

PART 3 - EXECUTION

3.1 CONDENSER WATER SYSTEM

A. Start-up Procedures: During condenser water system start-up, operate condenser water treating system to maintain the required steady-state characteristics of cooling water. Demonstrate system operation to Owner's operating personnel.

B. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standards, where applicable.
   1. ASTM D1067 - Tests for Acidity or Alkalinity of Water.
   2. ASTM D1068 - Tests for Iron in Water and Waste Water.
   3. ASTM D1126 - Tests for Hardness in Water.

3.2 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of condenser water treating systems including preparation of chemical solution reservoir. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

END OF SECTION

SECTION 23 25 19 - WATER TREATMENT FOR EVAPORATIVE CONDENSER COOLING TOWER SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Provide all equipment, chemicals, and treatment materials for the complete water treatment system.

B. Determine which chemicals to use for the results of a water sample analysis taken from the building domestic water supply.

C. Provide all water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for the cooling tower condenser water system.

1.3 REFERENCES

A. ASTM D596 - Standard Guide for Reporting Results of Analysis of Water; 2018.

B. ASTM D1067 - Standard Test Methods for Acidity or Alkalinity of Water; 2016.

C. ASTM D1068 - Standard Test Methods for Iron in Water; 2015.

D. ASTM D1126 - Standard Test Method for Hardness in Water; 2017.

1.4 SERVICE AND SUPPLIES

A. All work shall be performed by a qualified full-time water program manager.
   1. Specialist in the field of industrial water treatment.
   2. Facilities including water analysis laboratory, development facilities and service department.

B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride, and chemical residual) for field use.
   1. Reagents as required, suitable for specific use with the treatment products employs.

C. Where specialized supplementary testing or control equipment is required, the appropriate items shall be provided.

D. Provide a water management and service program for a period of one (1) year beginning at substantial completion of mechanical contractor’s scope of work.
   1. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
   2. Provide a water analysis report on each operating system.
   3. Analysis should include, but is not limited to:
      a. Corrosion inhibitor and/or organophosphate level to determine chemical residual value.
      b. Specific conductance in micro-ohms.

c. pH
d. Iron and/or copper
e. Sodium chloride
f. Calcium hardness
g. Methyl alkalinity

4. A system free of excess biomass and tube scale is required. Contractor warranty to cover restoring system to clean condition (if necessary) is required. Owner will clean the cooling tower and brush the condenser tubes annually.

E. Routine Services
1. Check and adjust water treatment system operation.
2. Specify chemical value limits with proposal. MSDS pages required on all products used.
3. Adjust chemical pump and/or panel during each visit to maintain supplier's pre-determined values. A minimum of four (4) cycles of water is required.
4. Instruct, train, and advise operating personnel.
5. Check efficiency of chemicals and chemical applications.
6. Maintain present chemical feed system, parts, and labor. Or, supply a chemical feed system at no cost that is appropriate for the size of the system, operating conditions, and water chemistry values.
7. Twice per year, perform a microbiological culture study on all systems.

F. Chemically clean the piping system. If galvanized piping is used, cleaning chemical and operating treatment chemicals cannot exceed a pH of 9.0.

G. Provide a complete laboratory analysis of water samples.

H. Provide review of report figures in the field water testing.

I. Provide report charts and log sheets, and reorder charts for maintenance of water control tests.

J. Establish the recommended maintenance schedule for analysis and replenishment of the corrosion inhibitors.

1.5 QUALITY ASSURANCE

A. Quality: The contractor for the work specified in this Section shall have:
1. Research and development facilities.
2. Regional laboratories capable of making water analysis.
3. A service department and qualified technical service representative located within a reasonable distance of the project site.
4. A Certified Water Technologist (CWT) professional qualification is preferred. Service representatives who are Registered Engineers of factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system manufacturer are acceptable.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Ensure that neither products, waste, blow-down, nor other effluents violate local, state, or federal laws or regulations in effect.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D596 for reporting. Indicate the ASTM best methods for each test. Tests will included by are not limited to conductivity, pH, chemical residual, iron, copper, and bacteria count.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, pumps, piping and tubing sizes, fittings, accessories, valves and connections and monitoring equipment.

C. Guarantee: Submit written guarantee, signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required to achieve the required performance, during a one (1) year period following the final start-up or the continued operation of the systems.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the water treating system shall submit four (4) copies of an “Agreement for Continued Service and the Owner’s Possible Acceptance.” Offer terms and conditions for furnishing chemical and providing continued testing and equipment for a one (1) year period with option for renewal of the Agreement by Owner.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Water Treatment Services

B. Kurita (U.S. Water/ChemCal)

C. Chem Treat

D. Garratt-Callahan

E. Nalco

2.2 CONDENSER WATER SYSTEM

A. INTERNET WATER TREATMENT DATABASE
   1. Contractor must provide, configure, and support an Internet-accessible database account for the retrieving, recording, and archiving of water treatment related information. Such a system must have the following features:
      a. Secure, password-protected access for each manager and their chosen operators.
      b. Access to the system from anywhere via the Internet.

c. Zero software requirements (Internet browser required for user).

d. Ability for facility operators to record routine test log data online.

e. Ability for facility director and operators to upload pertinent digital images and PDF files.

f. Retrieve service reports, operator logs, laboratory analysis, corrosion coupon reports, inventory, digital images, MSDSs, product data sheets, technical papers, procedures, surveys, and training information.

g. Graphing and trending capabilities for any recorded service report and/or facility operator test data entries.

h. Ability to set alarm limits and assign recipients for email alarm notifications for chosen test variables of service report and/or operator log entries.

i. Multiple security levels for various users.

j. Contractor training and in-services on use and navigation of the database system.

B. WATER TREATMENT CONTROLLER

1. Contractor must provide, install, program, and support a water treatment controller unit (i.e., Walchem Webmaster, eController, customizable PLC, or Hydro Triton)) for control of each condenser water treatment system. Such control equipment must have the following features:

a. Secure, password-protected access at controller unit keypad.

b. = Seven (7) 110 volt NO/NC relays, plus one (1) for alarms.

c. = Eight (8) 4-20 mA inputs.

d. = Six (6) digital inputs.

e. Ability to assign any input to any output online.

f. Output = (4) 4-20 mA signals.

g. Industrial grade ORP and conductivity sensors and housing as required per facility and system type.

h. Ability to feed oxidizing biocide base on ORP set point(s) and record ORP of condenser water for any given period.

i. Contractor training and in-services on use.

2. The contractor shall provide a dedicated 120V / 20 Amp electrical service outlet (non-GFCI outlet) at the water treatment control system location next to or adjacent to each evaporative condenser.

3. The contractor shall provide ¾” water line (i.e. at least 2 gpm at 60 psi with isolation valve) at the water treatment control system location next to or adjacent to each evaporative condenser.

C. CHEMICAL FEED AND STORAGE EQUIPMENT

1. Contractor must have the ability to deliver solid-concentrate/paste water treatment chemicals at each facility while minimizing the use of liquid chemicals, drums and pails. Contractor delivery technicians must be Hazmat trained and licensed truck drivers.

2. Contractor must provide, install, and support all relevant chemical feed and storage equipment necessary to treat the condenser water systems. The following water treatment equipment items must be installed and supported by the contractor:

a. Stainless steel square-tube framed rack with ½-inch Polyboard panel. Shall be floor anchored and secured for supporting all chemical feed and storage equipment below.

b. Solid-concentrate/paste chemical product dissolver system (i.e., APTech) with integrated reservoir. System must utilize fresh make-up water for solid chemical reconstitution wile incorporating float-weight and mechanical solenoid valve. Must include adjustable pressure gauge, removable filter, and atmospheric sipon breaker. One system required for each chemical specified.

c. Containment enclosure (i.e. Stahlin DS or equal) which is splash proof for each chemical injection pump. Composite fiberglass construction. One (1) enclosure required per chemical injection pump. Hinged door cover with corrosion resistant hinges. Enclosure must have sensor capable or interlocking injection pumps with leak detection.

d. Separate enclosure (i.e.; Stahlin DS or equal) for mounting water treatment controller unit and associated sensor/probe rack assemble and associated wiring. Hinged door cover with corrosion resistant hinges.

e. Acceptable water treatment controller unit (see section above).

f. Industrial grade ORP and conductivity probes/sensors.

g. Industrial grade inhibitor monitoring probe (i.e. Turner) to ensure proper dosage of scale and corrosion inhibitor chemical.

h. Chemical injection pumps (i.e. Iwaki, ProMinent) with controllable speed and stroke which are sized appropriately relative to the system volume and tonnage.

i. Rotometer (i.e. King) for bypass loop piping.

j. Two (2)-pass corrosion coupon rack made of schedule-80 PVC.

k. Blowdown solenoid valve (i.e. Walchem, Parker, or equal).

l. One (1)-inch schedule-80 PVC for bypass loop construction.

m. Chemical tubing containment from chemical reservoir to pump box and from pump box to injection point. Materials of construction shall be 1 ¼-inch clear vinyl hose secured with stainless steel hose clamps shall be installed over all plastic chemical tubing for containment purposes.

n. Vendor startup, training, and in-services on all provided equipment.

D. CHEMICALS - CONDENSER WATER

1. Contractor must select and deliver in one (1)-gallon containers, disks, or sticks, solid-concentrate/paste water treatment chemicals capable of inhibiting and controlling mineral scale, corrosion, microorganisms, and biological fouling (i.e., biofilm) on all water-side surfaces (i.e., cooling tower fill, basin, piping, heat-exchanger tubes) of the condenser water system. Chemical supply will be for one (1) year past Date of Substantial Completion.
2. The microbiocide program must be consistent with CTI (Cooling Technology Institute) and or AWT (Association of Water Technologies) guidelines relative to the control of condenser water pathogens such as Legionella.
3. Contractor must be able to control the condenser water at a minimum of four (4) cycles of concentration while maintaining a Ryznar Stability Index (RSI) between 4.0 and 4.8.

   a. Scale and corrosion inhibitor chemical. This product must be in solid-concentrate/paste form and impart the following active ingredients at the following dosages when fed in condenser water: 1) phosphonate = 3-7 ppm, 2) ter-polymer = 4-10 ppm, 3) azole = 2.4 ppm, and 5) PTSA dye. Feed of this chemical will be controlled by the inhibitor monitoring probe feature of the controller system.

b. Oxidizing microbiocide chemical. This product must be a solid/dry source of chlorine and/or bromine oxidizer chemistry types. This product must convey the following water test results during and shortly after feeding: 1) free oxidant = 0.1-0.5 ppm, 2) total oxidant = 0.4-1.0 ppm. This product must be fed in a manner to hold these residuals using the ORP sensor feature of the controller system.

4. OPERATOR TEST KIT

a. Contractor must select, prepare, and deliver a relevant test kit and components for operator's use for operator testing. Test kit must come in a carrying case for ease of handling and contain testing procedures, log sheets, and reagent MSDSs. Test kit shall contain all necessary reagents, glassware, color comparators, and a handheld conductivity meter (i.e., Myron L EP-10).

b. The contractor must provide a minimum of one (1) hour in-service to operators involved in routine testing. The contractor will replenish reagents at no charge for the one (1) year term.

PART 3 - EXECUTION

3.1 CONDENSER WATER SYSTEM

A. Start-up Procedures: During condenser water system start-up, operate condenser water treating system to maintain the required steady-state characteristics of cooling water. Demonstrate system operation to Owner's operating personnel.

B. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standards, where applicable.
1. ASTM D1067 - Tests for Acidity or Alkalinity of Water.
2. ASTM D1068 - Tests for Iron in Water and Waste Water.
3. ASTM D1126 - Tests for Hardness in Water.

3.2 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of condenser water treating systems including preparation of chemical solution reservoir. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

END OF SECTION

SECTION 23 31 13 - METAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure ductwork.
B. Medium and high pressure ductwork.
C. Casings.
D. Underground buried ducts.
E. Exposed ductwork located indoors.
F. Grease exhaust ductwork serving Type I hoods.
G. Domestic range hood exhaust ductwork.
H. Dishwasher ductwork/Ductwork serving Type II hoods.
I. Shower/Locker room exhaust ductwork.
J. Laboratory fume hood exhaust ductwork.
K. Chlorine storage area ductwork.
L. Duct exposed in pool room or pool equipment room.
M. Welding exhaust ductwork.
N. Paint hood exhaust ductwork.
O. Commercial dryer vent.
P. Duct leakage testing.
Q. Duct system protection.
R. Duct system cleaning.

1.2 RELATED SECTIONS

A. Division 9 - Finishes: Weld priming, weather resistant, paint or coating.
B. Section 23 02 00 - Basic Materials and Methods for HVAC
C. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC
D. Section 23 05 93 - Testing, Adjusting, And Balancing
E. Section 23 07 13 - DUCT INSULATION
F. Section 23 33 00 - DUCTWORK ACCESSORIES
G. Section 23 37 13 - Air Distribution Devices

1.3 REFERENCES

A. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

I. ASHRAE (FUND) ASHRAE Handbook - Fundamentals; Chapter 21 - Duct Design.

J. ASHRAE (HVACS) ASHRAE Handbook - HVAC Systems and Equipment; Chapter 19 - Duct Construction.

K. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. ICC (IECC) - International Energy Conservation Code.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer’s Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.5 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.6 SUBMITTALS

A. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.7 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2". Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2", and all supply ductwork downstream of terminal units in variable volume systems.

C. Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4". Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.

D. High Pressure: High pressure ductwork shall be rated for an operating pressure of 6", or the scheduled external pressure of the equipment it is connected to, whichever is greater. The supply ductwork of air handling units having a scheduled external static pressure greater than 4" shall be high pressure.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

C. The Contractor shall ensure that all ductwork either stored on site or installed in the building is thoroughly sealed to protect against dirt and moisture until such time that the building is deemed by the Owner to be adequately clean to allow for start-up of the associated air handling equipment. Should ductwork not be sealed as specified, then the Contractor shall have such ductwork professionally cleaned to an as-new condition at no cost to the owner.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A480/A480M; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non-combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 5M, Thermaflex MKE, ATCO #036 or approved equal.
   1. Flexible ducts shall be corrosive resistant galvanized steel formed and mechanically locked to inner fabric with minimum 1-1/2" thick, R-6 insulation. Flexible duct shall be rated up to at least 10 in.w.g. positive pressure and shall have reinforced metalized outer jacket to comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast “iron grip” or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
   1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
   2. For aluminum ductwork, provide aluminum support materials.

2.3 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer’s approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.4 MEDIUM AND HIGH PRESSURE DUCTS

A. Fabricate and support in accordance with SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) Standards and SMACNA High Pressure Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gauge galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cubic foot minimum glass fiber media, on inverted channels of 16 gauge.

2.6 BURIED UNDERGROUND DUCTS

A. Buried ducts may be concrete encased sheet metal or fiberglass reinforced plastic as indicated.

2.7 EXPOSED DUCTWORK LOCATED INDOORS

A. Where ductwork is indicated to be exposed to view in occupied spaces, provide round or flat oval, double wall galvanized steel construction with spiral lockseam with perforated inner liner, United McGill Corporation model Acousti-k27 or approved equal.

2.8 GREASE EXHAUST DUCTWORK SERVING TYPE I HOODS

A. Fabricate in accordance with SMACNA (DCS) Standards, and NFPA 96.

B. Construct of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

C. Slope all duct toward the kitchen hood or a grease reservoir so that grease cannot collect in any portion of duct per mechanical code.

2.9 DOMESTIC RANGE HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA (DCS) Standards.

B. Construct of minimum 26 gauge galvanized steel.

2.10 DISHWASHER DUCTWORK/DUCTWORK SERVING TYPE II HOODS

A. All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B. Slope all duct to drain toward the dishwasher/hood or provide drain line to floor drain.

2.11 SHOWER/LOCKER ROOM EXHAUST DUCTWORK

A. All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B. Slope all duct to drain out grilles or provide drain line to floor drain.

2.12 LABORATORY FUME HOOD EXHAUST DUCTWORK

A. Construct of 18 gauge type 316 stainless steel.

B. All welded construction.

2.13 CHLORINE STORAGE AREA DUCTWORK

A. 18 gauge minimum galvanized steel.

B. Three coat minimum, acid resistance, epoxy paint, minimum 6 mil dry film thickness total, inside of duct and outside of duct.

C. Paint after fabrication including all taps and grilles.

2.14 DUCT EXPOSED IN POOL ROOM OR POOL EQUIPMENT ROOM

A. 18 gauge minimum galvanized steel.

B. Two coat galv-grip primer.

C. Three coat minimum, acid resistant epoxy paint, minimum 6 mil dry film thickness total, exterior of duct, color to be selected by architect in the field.

D. Paint after fabrication, including all hangers, taps, grilles, return air grilles and louvers.

2.15 WELDING EXHAUST DUCTWORK

A. Construct of galvanized steel with spiral lockseam. Provide duct gauges, reinforcing, and sealing for operating pressures indicated.

B. Joints and fittings shall be flanged construction. All joints shall be gasketed or sealed.

2.16 PAINT HOOD EXHAUST DUCTWORK

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

2.17 COMMERCIAL DRYER VENT

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

C. Provide hard duct connection to dryer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect terminal units to medium or high pressure ducts with 18 inches maximum length of flexible duct. Do not use flexible duct to change direction.

E. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. All ductwork located exposed on roof shall be "crowned" to prevent water from ponding. Ref: Insulation for additional requirements.

I. Where ducts pass through non-rated floors, provide structural angles for duct support. Where ducts pass through non-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches. Where ducts pass through rated interior partitions, rated exterior walls, or rated floors, install fire dampers or smoke dampers as required. Provide sleeves for dampers not provided with factory sleeve. Refer to Section 23 33 00 - DUCTWORK ACCESSORIES for fire and smoke damper requirements.

J. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

K. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

L. All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA (DCS).

3.3 REQUIREMENTS FOR DUCTS BURIED UNDERGROUND

A. Slope underground ducts to plenums or low pump-out points at 1:500. Provide access doors for inspection.

B. Coat buried, metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

C. Insulate buried supply duct runs over 50 feet long with one inch thick insulation covered with plastic vapor barrier.

D. Encase buried metal ductwork in 3 inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.

3.4 REQUIREMENTS FOR UNIT CASINGS

A. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.5 REQUIREMENTS FOR GREASE EXHAUST DUCTWORK SERVING TYPE I HOODS

A. Provide residue traps in grease exhaust ducts at base of vertical risers with provisions for cleanout.

B. Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C. Use stainless steel for ductwork exposed to view.

3.6 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials shall be provided to comply with the following:

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Buried Supply or Return	Concrete, Glass Fiber Reinforced Plastic
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Grease Exhaust	Carbon Steel, Stainless Steel
Domestic Range Hood Exhaust	Galvanized Steel
Dishwasher/Ductwork Serving Type II Hoods	Stainless Steel
Shower/Locker Room/Dryer Vent/Paint Hood Exhaust	Stainless Steel
Fume Hood Exhaust	Stainless Steel
Chlorine Storage Supply and Exhaust	Galvanized Steel
Pool Room or Pool Equipment Room Supply, Return, and Exhaust	Galvanized Steel
Welding Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Emergency Generator Ventilation	Carbon Steel

3.7 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. Wire shall not be used for permanent support or attachment components unless specifically indicated or permitted otherwise.

C. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.8 AIR DUCT LEAKAGE: (FROM SMACNA DUCT STANDARDS LATEST EDITION) TEST ALL DUCTWORK (DESIGNED TO HANDLE OVER 1,000 CFM) AS FOLLOWS:

A. Test apparatus
   1. A source of high pressure air-a portable rotary blower or a tank type vacuum cleaner.
   2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures
   1. Test for audible leaks as follows:
   2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
      a. Start the blower with its control damper closed.
      b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
      c. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
   3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
      a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
      b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
      c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
      d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.
   4. Testing Report
      a. Contractor shall provide a testing report for each air system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.
      b. All duct testing reports shall be included in the final close out documents.

3.9 GREASE EXHAUST DUCT LEAKAGE: LIGHT TEST

A. Prior to the use or concealment of any portion of grease exhaust duct systems, a leakage test shall be performed on all grease exhaust duct as outlined below. Concealment shall be considered as anything that prevents visual inspection of the duct on all sides.

B. Test Apparatus
   1. The light source shall be fully open as to emit light equally in all directions perpendicular to the duct walls.
   2. The light source shall emit a minimum of 1,600 lumens.

C. Test Procedure
   1. Visually test for leaks as follows:
      a. The light source shall be passed through the entire duct system, including the hood to duct connection, with the light source emitting light perpendicular to the duct walls.
      b. Each duct wall and duct joint shall be visually inspected from the outside of the duct as the light source passes each portion of the duct system.
      c. If any light is visible from the outside of the duct, these leakage locations shall be marked for correction.
      d. All leaks discovered during the visual test shall be corrected as required to prevent leakage.
      e. After all repairs have been completed, the visual light test shall be repeated until no leaks are present.
   2. Testing Report
      a. Contractor shall provide a testing report for each grease exhaust duct system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.
      b. All duct testing reports shall be included in the final close out documents.

3.10 DUCT SYSTEM PROTECTION

A. The Contractor shall ensure that all ductwork either stored on site or installed in the building is thoroughly sealed to protect against dirt and moisture until such time that the building is deemed by the Owner to be adequately clean to allow for start-up of the associated air handling equipment. Should ductwork not be sealed as specified, then the Contractor shall have such ductwork professionally cleaned to an as-new condition at no cost to the Owner.

B. Provide temporary closures at the ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation; provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

C. Provide temporary construction filters on air handling equipment and/or return air ductwork during construction to protect ductwork and equipment from dust.

D. Any ductwork stored on site with observable dirt or debris inside shall be cleaned by a third party at no cost to the Owner.

E. If the air handling system has been operated without temporary construction filters or if the integrity of the temporary closures has been compromised, the contractor shall have the duct system cleaned per the following section.

3.11 DUCT SYSTEM CLEANING

A. For renovation projects and HVAC retrofit applications wherein existing duct systems are scheduled to be re-used, or where required by the Duct System Protection section above, the contractor shall have the existing duct systems cleaned in accordance with the current published standards of ASHRAE, NADCA ACR and as indicated below.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.12 DUCT JOINTS AND SEAMS

A. All ductwork shall be constructed to Seal Class A, as referenced in SMACNA (DCS).

B. All non-welded joints and seams shall be sealed. This includes but is not limited to:
   1. Transverse joints.
   2. Longitudinal seams.
   3. Duct wall penetrations.
   4. Spin-ins, taps, and other branch connections.
   5. Access doors, access panels, and duct connections to equipment.

C. Openings for rotating shafts shall be sealed with bushings.

END OF SECTION

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Volume control dampers.
B. Shutoff Dampers.
C. Round Duct Taps.
D. Conical Duct Taps.
E. Fire dampers.
F. Combination fire and smoke dampers.
G. Back draft dampers.
H. Air turning devices.
I. Flexible duct connections.
J. Duct access doors.
K. Duct test holes.

1.2 RELATED WORK

A. Section 23 02 00 - Basic Materials and Methods for HVAC
B. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
C. Section 23 31 13 - Metal Ductwork

1.3 REFERENCES

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
F. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
G. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
H. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.
B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C. Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers and combination fire and smoke dampers.

PART 2 - PRODUCTS

2.1 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.
   1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.

F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.2 SHUTOFF DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Provide Class I multi-blade damper of parallel blade pattern for all ductwork systems which penetrate the building thermal envelope in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.
   1. Damper shall be constructed of one-piece 16 ga. roll-formed galvanized steel hat-shaped channel frame. Blades shall be 14 ga. roll-formed galvanized steel, airfoil type. Blade edge seals shall be neoprene gaskets mechanically locked to blade edge. Bearings shall be 304 stainless steel, oil-impregnated and self-lubricating sleeve type, turning in extruded holes in damper frame.

C. Shutoff dampers shall have an air leakage rate not greater than 4 cfm/ft^2 of damper surface area at 1.0 in.w.g. and shall be labeled by an approved agency when tested in accordance with AMCA 500-D for such purpose.

2.3 ROUND DUCT TAPS

A. Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.4 CONICAL DUCT TAPS

A. Taps to trunk duct for primary air inlet to all VAV terminal units shall be conical fitting, model no. CB by Flexmaster or approved equal.

2.5 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A. Greenheck.

B. Louvers and Dampers Inc.

C. Ruskin.

D. Nailor Industries.

E. Pottorff.

2.6 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream. Provide factory sleeve for each damper.

C. Fabricate multiple blade fire dampers per UL with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

D. Fusible links, UL 33, shall separate at 165 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S and as indicated.

B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.

C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
   1. Operators shall be spring return electric type suitable to operate on 120 VAC, 60 cycle.
   2. Operators shall be UL listed and labeled.

2.8 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, UL 555S and as indicated.

B. Motorized Smoke Dampers: multi-blade type, normally open with power on, close automatically when power is interrupted, UL-listed and labeled damper and damper operator.

2.9 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck.
B. American Warming and Vent.
C. Louvers and Dampers Inc.
D. Ruskin.
E. Pottorff.
F. Substitutions: Under provisions of Division One.

2.10 BACKDRAFT DAMPERS

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.
B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge galvanized steel, or extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
C. Gravity backdraft dampers shall have an air leakage not greater than 20 cfm/ft^2 where not less than 24 inches in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 in.w.g. when tested in accordance with AMCA 500-D for such purpose.

2.11 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

A. Young Regulator.
B. Titus.
C. Tuttle and Bailey.
D. Substitutions: Under provisions of Division One.

2.12 AIR TURNING DEVICES

A. On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.
B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18 inch long removable key operator.

2.13 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A. Metaledge.
B. Ventglass.
C. Substitutions: Under provisions of Division One.

2.14 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 6 inches wide, crimped into metal edging strip.

2.15 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A. Greenheck.
B. American Warming and Vent.
C. Ruskin.
D. Titus.
E. Substitutions: Under provisions of Division One.

2.16 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.
B. Review locations prior to fabrication.
C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.
D. Access doors smaller than 12 inches square may be secured with sash locks.
E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.
F. Access doors with sheet metal screw fasteners are not acceptable.

2.17 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.
B. Balancing Dampers
   1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.
   2. All regulators mounted on externally insulated ductwork shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.
   3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

E. Provide gravity backdraft dampers or motorized shutoff dampers in accessible location nearest to exterior wall/roof penetrations and where indicated for all outdoor air intake and exhaust systems to automatically shut when the associated systems or spaces served are not in use.

F. Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

H. Provide duct access doors for inspection and maintenance of all fire dampers, smoke dampers, and combination fire/smoke dampers. Provide minimum 12 x 12 inch size access opening where duct size permits. All duct sizes that cannot accommodate a minimum 12 x 12 inch access opening shall be provided with a removable duct section to permit inspection and maintenance of the damper and its operating parts. Removable duct sections shall match the pressure class of the associated duct system, maintain 100 percent of the duct free area, and utilize gaskets and clamp type draw latches to allow removal and reinstallation without the use of tools.

I. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION

SECTION 23 33 19 - DUCT SILENCERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 WORK INCLUDED

A. Duct silencers.

1.3 RELATED SECTIONS

A. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

B. Section 23 33 00 - DUCTWORK ACCESSORIES

1.4 REFERENCES

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASHRAE (HVACS) - ASHRAE Handbook - HVAC Systems and Equipment; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM E477 - Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers; 2020.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Duct silencer performance ratings shall be determined in accordance with ASTM E477.

B. Combustion ratings for duct silencer acoustic fill shall be in accordance with ASTM E84 or UL 723.

1.6 SUBMITTALS

A. Performance Data:

1. Silencer manufacturer to provide submittal drawings detailing all duct silencer data specified in the mechanical drawing schedule.
2. Submit laboratory acoustic and aerodynamic performance obtained according to ASTM E477 and so certified when submitted for approval. The test facility must provide for airflow in both directions through the test silencer. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption. The laboratory must be currently NVLAP accredited for the ASTM E477 test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted. Shop drawings submitted without proper certifications will be rejected.
    a. Submitted silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E477 test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.
    b. The manufacturer shall supply certified dynamic insertion loss and self-noise power level data for each scheduled silencer. The data shall match the project's air distribution system requirement for forward or reverse flow, and total system airflow. All ASTM E477 tests to obtain this data shall be conducted in the same facility and shall utilize the same silencer.
    c. Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule.
    d. Silencer generated noise shall not be greater than that listed in the silencer schedule
3. The silencer manufacturer shall provide, for approval, acoustical system calculations for all duct systems with silencers to demonstrate that the submitted silencers will reduce mechanical fan noise to the noise criteria in the occupied spaces as indicated in the ASHRAE (HVACA) and as indicated below:

Space Occupancy Type	NC Level
Conference/Meeting Rooms	≤NC30
Private Offices	≤NC30
Open Offices	≤NC40
Classrooms	≤NC30
Laboratories	≤NC35
Corridors, Utility Rooms and Restrooms	≤NC40
Churches	≤NC25
Courtrooms	≤NC30
Auditoriums	≤NC20
Libraries	≤NC30

4. Use sound power levels of actual equipment to be installed on project for calculations. Analysis shall include breakout noise calculations. In the absence of specified background sound level criteria, the guidelines as expressed in Table 1 of Chapter 49, "Noise and Vibration Control" of the ASHRAE (HVACA), shall be used.

B. Source quality-control reports:
1. Silencer manufacturer to provide a copy of their laboratory NVLAP accreditation certificate for the ASTM E477 test standard with the submittals. Data from non-NVLAP accredited test facilities will not be accepted.

1.7 DELIVERY, STORAGE AND HANDLING

A. Duct silencers shall be storage and handled in accordance with the manufacturer's instructions.

B. Shipping Protection: Silencers shall be shipped with factory-installed end caps to prevent contamination during shipping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vibro-Acoustics
B. Kinetics Noise Control
C. BRD Noise and Vibration Control
D. Ruskin
E. Price
F. IAC

2.2 DUCT SILENCERS

A. General Requirements:
   1. Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer.
   2. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.
   3. Silencers shall be constructed in accordance with ASHRAE (HVACS) and SMACNA (DCS) standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in other sections are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
   4. All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed unless otherwise stated in the silencer schedule, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
   5. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.
   6. Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, film liner, sealants, and acoustical spacer, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E84, or UL 723.
   7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE Std 62.1.

B. Rectangular Silencers: Outer casing shall be ASTM A653/A653M, G90 galvanized sheet steel, 22 gauge.

C. Rectangular Elbow Silencers: Outer casing shall be ASTM A653/A653M, G90 galvanized sheet steel, 18 gauge. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48” shall have at least two half splitters and one full splitter.

D. Circular Silencers: Outer casing shall be ASTM A653/A653M, G90 galvanized sheet steel, gauge as listed below.
   1. Sheet metal thickness for units up to 18 Inches in Diameter: 22 gauge.

2. Sheet metal thickness for units 18 through 30 Inches in Diameter: 20 gauge.
3. Sheet metal thickness for units 30 through 54 Inches in Diameter: 18 gauge.
4. Sheet metal thickness for units over 54 Inches in Diameter: 16 gauge.

E. Transitional Silencers: Outer casing shall be ASTM A653/A653M, G90 galvanized sheet steel, 22 gauge. Transitioning shall occur internal to the silencer such that the height of the gap or air passage is uniformly changing with the length of the splitters.

F. Inner perforated metal liner: ASTM A653/A653M, G90 galvanized sheet steel.
1. Rectangular Silencers: 26 gauge.
2. Rectangular Elbow Silencers: 22 gauge.
3. Circular Silencers:
    a. Connection diameter up to 18 inches: 26 gauge.
    b. Connection diameter greater than 18 inches: 22 gauge.
4. Transitional Silencers: 22 gauge.

G. Principal Sound-Absorbing Mechanism:
1. Dissipative and Film Lined silencers:
    a. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.

H. Media Protection:
1. Dissipative silencers: Where indicated on the silencer schedule, media shall be encapsulated in glass fiber cloth to help prevent shedding, erosion and impregnation of the glass fiber. All Axial Cone silencers shall have a glass fiber cloth liner.
2. Film Lined silencers: The acoustic media shall be completely wrapped with film to help prevent shedding, erosion and impregnation. The wrapped acoustic media shall be separated from the perforated metal by a factory installed ½" thick acoustically transparent spacer. The spacer shall be flame retardant and erosion resistant. A mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer. Silencer manufacturer shall provide a written test report by a third party organization showing silencer assemblies have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E84 or UL 723.

I. Accessories:
1. Access Doors: Where indicated on the silencer schedule, silencers shall be supplied with an access door(s) to permit fire damper service. Access doors shall be supplied as an integral part of the silencer by the silencer manufacturer. Where HTL walls are also supplied, the access doors shall not reduce the effectiveness of the HTL walls.

J. Source Quality Control: Test according to ASTM E477.
1. The manufacturer shall test the silencer(s) as indicated in the silencer schedule. The engineer shall be notified of the test date at least two weeks in advance and the test may be witnessed by the engineer. Test shall show compliance with the project criteria and is subject to engineer approval.
2. Test facilities and test reports shall be open to inspection upon request from the Engineer. Silencer performance must have been substantiated by laboratory testing according to ASTM E477 and so certified when submitted for approval. The aero-acoustic laboratory must be NVLAP accredited for the ASTM E477 test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted.

K. Capacities and Characteristics:

1. See duct silencer performance schedule on mechanical drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install silencers in accordance with NFPA 90A, NFPA 90B, and the manufacturer's written installation instructions.

B. Silencers shall be supported from the building structure independently of ducts.

C. The Mechanical Contractor shall provide all necessary transitions as required to adapt the silencer dimensions to the connecting ductwork.

D. Provide flexible duct connections between silencers and connecting ducts.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Ensure duct silencers are installed with airflow arrows in direction of airflow.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Centrifugal roof ventilators

B. Ceiling and inline ventilators

C. Roof supply fans

D. Utility fans

E. Kitchen hood upblast roof exhaust fans

F. Propeller wall axial ventilators and assemblies located in pool rooms

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 33 00 - DUCTWORK ACCESSORIES

1.4 REFERENCES

A. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

C. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).

D. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

F. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.

G. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.

H. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

J. FLA (FBC-B) - Florida Building Code: Building (8th Edition); 2023, with Supplement (2024).

K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

P. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

Q. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

R. UL 705 Supplement SC - (Formerly UL-762) - Standard Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

S. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70.

F. Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA 300 Seal.

G. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

H. Motors for fans that are not less than 1/12 hp (0.082 kW) and less than 1 hp (0.746 kW) shall be electronically commutated motors per ICC (IECC) and ASHRAE Std 90.1 I-P.

I. High Wind models shall be analyzed and stamped by a state license P.E. to the ASCE 7-16 Standard which meets the ICC (IBC), FLA (FBC-B), and Miami (APD) codes.

J. Each High Wind model is subject to be certified by a Nationally Recognized Testing Laboratory to ASTM E330/E330M.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:
   1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.
5. Dampers, including housings, linkages, and operators.
6. Full color paint samples.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer`s designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer`s written instructions.

D. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck Fan Corporation
B. Loren Cook Company
C. ACME
D. Twin City Fan and Blower

2.2 GENERAL DESCRIPTION

A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.
B. Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
C. Provide factory baked-enamel finish coat after assembly. Color for roof mounted fans shall be chosen by Architect during the submittal process.

2.3 CENTRIFUGAL ROOF VENTILATORS

A. Fan shall be a spun aluminum, centrifugal, roof mounted, direct driven or belt driven as indicated.
B. Fan shall be UL 705 listed. Fan shall bear the AMCA certified ratings seal for sound and air performance.
C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.
D. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. A discharge baffle conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.
E. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in transit tested packaging.
F. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA 204, balance quality and vibration levels for fans.
G. Motor shall be heavy duty type with permanently lubricated sealed ball bearings.
H. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty re-greaseable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
I. Accessories: The following accessories are required.
    1. Disconnect Switch: Non-fusible type, with thermal overload protection, mounted inside fan housing, factory-wired through an internal aluminum conduit.
    2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - DUCTWORK ACCESSORIES.
4. Roof Curbs: Prefabricated, minimum 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base. Roof curb shall match roof slope so that the curb is level.

2.4 CEILING AND INLINE VENTILATORS

A. Ceiling and inline ventilators shall be direct drive or belt drive as indicated, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of minimum 20 gauge corrosion resistant galvanized steel and acoustically insulated for quiet operation. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The ceiling ventilators shall be furnished standard with a powder-painted white steel grille.

B. Ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ventilator performance shall be based on tests and procedures performed in accordance with AMCA 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA 311 and comply with the requirements of the AMCA Certified Ratings Program. Ventilators shall be UL listed and CSA certified.

C. Accessories: The following accessories are required.
   1. Dampers:
      a. Aluminum backdraft damper.
      b. Motor-operated volume control damper.
      c. L listed ceiling radiation damper for ceiling fans comply with NFPA 90A rated for 3 hours
   2. Disconnect Switch: Nonfusible type with thermal overload protection.
   3. Speed Controls: Fan mounted, solid state speed controller.

2.5 ROOF SUPPLY FANS

A. Roof-mounted, filtered air supply units are of the belt-driven, double width, double inlet (DWDI), forward curved centrifugal blower type. The unit’s blower assembly shall be mounted on vibration isolators. Motor drives shall be machine cast iron and variable pitch and shall be factory set to the specified RPM. Belts shall be non-static and oil resistant. Both motor and blower bearings shall be permanently lubricated with sealed ball bearings. The blower housing shall be fabricated of heavy gauge painted steel.

B. Fan shall be UL 705 listed and shall bear the AMCA certified rating seal for sound and air performance.

C. Units housing shall be minimum 18 gauge extruded aluminum with a removable aluminum cover. The insulated cover shall be held in place with bolts for easy access to fan components.

D. Filters shall be permanent, one inch, washable, aluminum type and shall be easily removed for cleaning. Units carry the AMCA Certified Ratings Seal for air performance with filters in place.

E. Accessories: The following items are required.
   1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
   2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - DUCTWORK ACCESSORIES.
4. Roof Curb: Prefabricated, minimum 12 inch high, heavy gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base.

2.6 UTILITY FANS

A. Fans shall be of the direct driven or belt driven utility fan type as indicated with a single width, single inlet housing in AMCA arrangement 10.

B. The housing shall be constructed of minimum 14 gauge steel with continuously welded or lock formed seams permitting no air leakage. The housing shall be field rotatable to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of minimum 10 gauge welded steel members to prevent vibration and rigidly support the shaft and bearings. Side access inspection port shall be provided for access to the motor compartments.

C. The fan wheel shall be of the forward curved type C, non-overloading backward inclined, centrifugal fan type and constructed of heavy gauge steel.

D. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.

E. Motors shall be permanently lubricated, heavy duty, ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

F. Fan performance shall be based on tests conducted in accordance with AMCA 210. Fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.

2.7 KITCHEN HOOD UPBLAST ROOF EXHAUST FANS

A. General Description
   1. Discharge air up and away from the mounting surface.
   2. Upblast fan shall be for roof mounted applications.
   3. Maximum continuous operating temperature is 400°F.
   4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Fan shall be direct-driven or belt-driven as indicated.
   1. Fan Wheel
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced in accordance to AMCA 204.
      c. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
   2. Housing
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.

c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.

d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.

e. Provide breather tube for fresh air motor cooling and wiring.

f. Provide an access opening on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades per NFPA 96. Access opening shall be a minimum 3 in. by 5 in. rectangular or minimum 4 in. diameter circular opening.

C. Shafts and Bearings
1. Fan Shaft
   a. Ground and polished steel with anti-corrosive coating.
   b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings
   a. Permanently sealed or pillow block type.
   b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
   c. 100 percent factory tested.

D. Drive Assembly
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. The motor pulley shall be adjustable for final system balancing.
5. Readily accessible for maintenance.

E. Roof Curb: Minimum 12-inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Roof curb shall match roof slope so that the curb is level.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Accessories: The following accessories are required.
1. Birdscreen
   a. Provide aluminum construction.
   b. Protects fan discharge.
2. Roof Curb Extension: Provide vented curb extension per NFPA 96. Verify curb height with extension has a minimum of 40 inches clearance from the discharge lip of the fan to the finished roof.
3. Drain Connection:
   a. Aluminum construction.
   b. Allows single-point drainage of grease, water, or other residues.
4. Grease Trap:
   a. Provide aluminum grease receptacle as required by NFPA 96.
   b. Includes drain connection.
   c. Collects grease residue.
5. Hinge Kit (factory Installed)
   a. Aluminum hinges.
   b. Hinges and restraint cables mounted to base (sleeve).

c. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning.

6. Heat Baffle:
   a. Provide 1-inch thick insulation shield that prevents heat from radiating into the motor compartment to meet requirements of UL 705 Supplement SC.
7. Variable Speed Control:
   a. Provide an electronically commutated motor or a premium efficiency AC induction paired with a variable frequency drive capable of variable speed control for demand-based ventilation sequencing as required by the kitchen hood ventilation controls.

2.8 PROPELLER WALL AXIAL VENTILATORS AND ASSEMBLIES LOCATED IN POOL ROOMS

A. Unless noted otherwise, all materials shall be of noncorrosive aluminum or stainless steel.

B. Ventilator and assembly shall consist of propeller wall axial ventilator section, motorized damper section and accessories as scheduled.

C. Motorized Damper Section:
   1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.
   2. Blade edge seals shall be Ruskiprene type or equivalent, mechanically locked in extruded blade slots.
   3. Linkage shall be stainless steel, mounted in frame.
   4. Axles shall be square or hexagonal, stainless steel construction.
   5. Bearings shall be non-corrosive molded synthetic.
   6. Shaft shall be stainless steel.
   7. Damper actuator shall be mounted inside NEMA 4 type enclosure, factory wired through an internal aluminum conduit.

D. Gravity Damper Section:
   1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.

E. Propeller Wall Axial Ventilator Section:
   1. Fan motor shall be in TEFC type enclosure.
   2. All steel fan components shall be coated with Air Dry Phenolic (Heresite VR-500) coating.

F. Wall collar shall be of aluminum construction.

G. Accessories: The following items are required.
   1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside NEMA 4 enclosure, factory-wired through an internal aluminum conduit.
   2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

D. Refer to 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT for additional installation requirements.

E. Flexible duct connections and shutoff dampers are prohibited from being installed in duct systems conveying grease laden exhaust air per NFPA 96 requirements.

END OF SECTION

SECTION 23 35 13 - DUST COLLECTION SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Dust Collection Machine.

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. Section 23 05 93 - Testing, Adjusting, And Balancing

D. Section 23 31 13 - Metal Ductwork

1.4 REFERENCES

A. NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection; 2017.

B. NFPA 652 - Standard on the Fundamentals of Combustible Dust; 2019.

C. NFPA 654 - Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids; 2020.

D. NFPA 68 - Standard on Explosion Protection By Deflagration Venting; 2017.

E. NFPA 69 - Standard on Explosion Prevention Systems; 2019.

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

G. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Provide dust collection equipment that is in compliance with requirements of the latest versions of NFPA 68, NFPA 69, NFPA 652, and NFPA 654.

B. Installation and Start-up: Provide services of a representative authorized by the manufacturer to perform inspection, start-up and certification of each unit.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Provide complete submittal data for each dust collection unit including, but not limited to the following:
   1. Materials of construction, types and gauges of frame, panels, and supports.
   2. Dimensions and weights.

3. Collector options and accessories.
4. Equipment design parameters.
5. Sound data including sound power levels for outlet at operating point.
6. Complete fan performance curves with operating point identified.
7. Electrical data including wiring diagrams.
8. Preparation instructions and recommendations.
9. Manufacturer's Installation instructions.
10. Manufacturer's operation and maintenance instructions.
11. Equipment and accessory design layout and details for inlet fittings.
12. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling: Handle dust collection equipment to prevent damage, denting and scoring. Do not install damaged equipment. Replace damage equipment with new.

B. Storage: Store equipment and components in a clean dry place. Protect from the weather, dirt, water and construction debris, and physical damage.

1.8 WARRANTY

A. Provide a manufacturer's warranty for two years from date of shipment from defects in material and workmanship when used in a proper and normal manner. Manufacturer shall have the option to repair or replace any defective part.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. AAF

B. Sternvent

C. Donaldson Torit

2.2 GENERAL DESCRIPTION

A. Dust collector shall be a completely self-contained shaker type unit as indicated on the plans. Unit shall consist of a collector housing, fan, motor, filter element, automatic shaker, and any specified accessories.

B. Unit shall be rated for the airflow and external static pressure as indicated on the plans.

2.3 HOUSING

A. Overall construction of the housing shall be minimum 12 gauge ASTM hot rolled steel.

B. Housing shall have a pressure rating of +/- 20” W.G.

C. The housing shall be factory polyester powder coated on the interior and exterior.

D. The hopper located at the bottom of the unit shall be constructed of 12 gauge hot rolled steel and shall be sloped toward the center of the unit terminating with a flanged outlet for drum connection. Unit shall be designed to accommodate standard 55 gallon drums. Outlet drums shall be provided with explosion proof quick opening, positive locking, barrel top adaptors to prevent air/dust leakage and to remain intact should an explosion occur. Flexible connectors are not acceptable.

E. Integral lifting lugs shall be provided for placement of the equipment.

2.4 FANS AND MOTORS

A. The fan shall be a Class III, direct drive, backward inclined, non-overloading, with TEFC motor rated for voltage and horsepower as indicated on the plans.

B. The fan and motor assembly shall be dynamically balanced at the factory for smooth vibration free operation per standard ANSI S2 19-1975, Grade G6.3. The fan shall be AMCA certified for air performance.

C. The fan motor shall be removable without removing the fan assembly to ease service of the fan and motor assembly.

D. The fan shall have outboard grease fittings to allow for ease of maintenance. The fan bearings shall be heavy-duty and have a minimum L10 life for 50,000 hours with an average life of 150,000 to 250,000 hours.

E. Fan mounting and wiring shall be provided by the installing Contractor.

2.5 SHAKER

A. An automatic filter cleaning shaker system shall be provided that distributes shaking force throughout the entire surface of each individual filter pocket. Pockets shall be held tightly by the shaker comb which imparts acceleration from a motorized eccentric driven shaker assembly.

B. Operation of the automatic shaker shall be controlled by a UL 508 labeled control panel with built in starter, transformer, and shaker control. The shaker control panel, transformer, and starter shall match the fan motor voltage. The control shall include adjustable fan delay cycle and automatic shaker cycle. A hand-off-auto switch shall be included with the control panel. The panel shall be factory installed in a NEMA 4 enclosure with all wiring to be installed at the factory except the wiring to the fan. Fan mounting and wiring shall be provided by the installing Contractor.

2.6 FILTERS

A. Filter shall consist of a high efficiency media with individual pockets of sewn cotton sateen or polyester sateen designed to deliver a minimum of 99% efficiency by weight on fine industrial dusts. The filter shall have rigid separators to prevent pocket collapse and to channel cleaned air in a laminar flow profile into the fan inlet cone. Adjacent filter pockets shall be positioned by steel bars at the top and a shaker comb at the bottom to keep the pockets open and separated.

B. Filter access shall be through full height hinged or removable doors with quick opening, flush latches for ease of maintenance. Filter assembly shall slide in and out of the unit over a steel frame. Filter assemblies shall be locked in place during operation by cam style locking mechanisms.

2.7 ACCESSORIES

A. Provide the fan assembly with an outlet silencer and transition piece for sound attenuation. Provide the outlet silencer with weather hood. Installing Contractor shall be responsible for installing silencer, weather hood, and transition piece to the outlet of the fan assembly. Installing Contractor shall provide separate support for the outlet silencer as required.

B. Provide dust collector with a No Return Valve (NRV) installed on the inlet ductwork routing to the dust collector. The NRV shall be the same size as the inlet ductwork as indicated on the plans. Installing Contractor shall provide separate support for the NRV.

C. Provide remote start/stop pushbutton control station for dust collector control. Pushbutton station shall be provided with a NEMA 1 enclosure and shall be field installed and wired by the Contractor.

D. A Magnehelic differential pressure gauge shall be provided to indicate status of filter loading.

E. Provide dust collector with factory installed explosion vent on the housing to relieve pressure from an explosion. Explosion vent shall be rated to open prior to failure of the dust collector housing. Explosion vents shall be located as to discharge in a location that will be non-hazardous to building occupants. Horizontally opening vents shall be provided with a permanently installed vent deflector to provide vertical deflection in the case of a deflagation or explosion. Vent deflector shall be EcoMaxx Vigispace or approved equal.

F. Provide after filter housing that is factory mounted between main filter section and the fan section. After filters shall be 90-95% efficient filters and shall be shipped separate for field installation in after filter housing. The after filter housing shall be a side loading housing with positive locking arms for high efficiency. The system shall be designed to prevent return of dust with a minimum efficiency of 99.9% at 10µm.

G. Provide system with listed spark detection, designed and installed in conformance with the relevant sections of NFPA 72 located on the duct upstream from the dust collector and downstream from the last material entry point, connected directly to a listed spark extinguishing system, designed and installed in conformance with NFPA 15.

H. Provide system with a listed spark detection system, designed and installed in conformance with the relevant sections of NFPA 72 located on the duct upstream from the dust collector and downstream from the last material entry point, or on the exhaust side of the dust collector, to detect fire entering or occurring within the dust collector, respectively. The exhaust air duct conveying the recycled air back to the building shall be equipped with a high-speed abort gate activated by the spark detector, and the abort gate shall be sufficiently fast to intercept and divert any burning material to atmosphere before it can enter the building. The abort gate shall be provided with a manual reset so that, after it has aborted, it can be reset to the normal position only by manual interaction at the damper; automatic or remote reset shall not be allowed. A powered reset is acceptable if it can be activated only by manual interaction at the damper location.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

C. Fire dampers, explosion vents, no return isolation valves, etc., shall be installed in accordance with the latest NFPA Standards and local fire ordinances.

D. All ductwork located between the dust collector and the No Return Valve (NRV) shall be a minimum of two gauges thicker than the gauge required to handle the associated duct system pressure.

END OF SECTION

SECTION 23 36 13 - SERIES FAN-POWERED TERMINAL UNITS
SERIES FAN-POWERED TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Series type fan-powered terminal unit.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC
B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
C. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
D. Section 23 05 93 - Testing, Adjusting, And Balancing
E. Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS
F. Section 23 09 63 - Energy Management and Control System (EMCS)
G. Section 23 31 13 - Metal Ductwork
H. Section 23 33 00 - DUCTWORK ACCESSORIES
I. Section 23 34 00 - HVAC Fans
J. Section 23 73 13 - Modular Indoor Central Station Air Handling Units
K. Section 23 81 19 - Self Contained Air Conditioners

1.3 REFERENCES

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
C. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets; 2008, with Addendum (2011).
D. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

A. Terminal Units shall be AHRI 880 (I-P) certified and carry the AHRI Seal.
B. The terminal units shall be designed, built and tested as a single unit including fan motor and fan assembly, primary air damper assembly, water or electric heating coils and accessories.
C. The entire terminal unit and all electrical components shall be UL listed and installed in accordance with the NFPA 70.

1.5 GENERAL DESCRIPTIONS

A. Furnish, and install fan powered terminal units of the sizes and capacities shown on the plans.

B. Terminal Unit shall ship as a complete assembly requiring no field assembly (including accessories). Terminal unit manufacture shall factory mount EMCS controls, provided by Section 23 09 63 (EMCS contractor).

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finished of materials.

D. Submit product data or filter media and filter performance data.

E. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

F. Submit manufacturer’s installation instructions under provisions of Division 01.

G. Submit operation and maintenance data under provisions of Section 23 02 00.

H. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

I. Terminal units shall include a QR code tag to link directly to the specific IOM for the terminal unit to be accessed by mobile device.

1.7 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer’s instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On-site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. TITUS
B. METALAIRE
C. KRUEGER
D. NAILOR INDUSTRIES
E. PRICE

2.2 TERMINAL CASING

A. The terminal casing shall be minimum 20 gauge galvanized steel, internally lined with 1" natural fiber or fiberglass free insulation which complies with UL 181 with regard to resistance to erosion and mold growth and NFPA 90A. Insulation shall have R-values of 4.0. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing. The fasteners shall be weld pins. Lining material glued in place without mechanical fasteners are not acceptable. Any exposed insulation edges shall be coated with NFPA 90A approved sealant, or covered with galvanized brackets or foil tape. The terminal shall have round duct collars for the primary air connections and a rectangular discharge suitable for flanged duct connection. The casing shall be provided with mounting brackets for hanging from structure.
B. The terminal casing shall have a bottom or side access panel, which allows removal of fan and servicing of terminal without disturbing duct connections.
C. The terminal casing shall have a filter rack/bracket for securing the air filter over the return air inlet. This filter rack shall be sized so that standard sized filters can be installed by the owner as part of ongoing maintenance.

2.3 FAN AND FAN MOTOR

A. The fan shall be constructed of steel and have a forward curved dynamically balanced wheel with direct drive motor.
B. The terminal unit shall utilize an ECM variable-speed DC brushless motors specifically designed for use with single phase, 277 volt, 60 hertz electrical input. Motor shall be complete and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be directly coupled to the blower. Motor shall maintain a minimum of 70 percent efficiency over its entire operating range. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.
C. The terminal unit manufacturer shall provide a factory-installed controller for digitally controlled automatic fan cfm adjustment. The remote PWM controller shall be capable of receiving a 0-10 Vdc signal from the DDC controller (provided by the controls contractor) to control the fan cfm.

2.4 CONTROL DAMPER

A. Cooling inlet shall have a damper assembly with factory set and calibrated pressure independent control. The damper shall be heavy gauge steel with shaft rotating in Delrin (Polyoxymethylene) self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent over-stroking and a synthetic seal to limit close-off leakage.

B. Damper and casing leakage shall be tested in accordance with ASHRAE Std 130 and shall not exceed 2% of rated airflow based on a nominal inlet velocity of 2000 fpm at 2.0 in.w.g. of static pressure.

C. Terminals with interior actuator linkage connection must include gasketed access panel, removable without disturbing ductwork.

2.5 HOT WATER HEATING COILS

A. Hot water heating coils shall be enclosed in a minimum 20 gauge galvanized steel casing with flanged construction for attachment to metal ductwork. Coils shall be factory installed on the terminal. Fins shall be rippled and corrugated heavy gauge aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of 0.016”, with male solder header connections. Coils shall be leak tested to 500 psi, with an operating pressure of 360 psi and a minimum burst pressure of 2000 psi at ambient temperature. Number of coil rows and circuits shall be selected to provide performance as required per the plans. Coil performance data shall be based on tests run in accordance with AHRI 410.

2.6 ELECTRIC HEATING COILS

A. Modulating electric coils shall be supplied and installed on the terminal unit by the manufacturer. Coils shall be ETL listed. Coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge a minimum of 5 inches to prevent damage to elements during shipping and installation. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3½ inches apart, staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step. The integral control panel shall be housed in a NEMA 1 enclosure with a hinged access door for access to all controls and safety devices.

B. Electric coils shall contain a primary automatic reset thermal cutout, a secondary replaceable heat limiter per element, differential pressure airflow switch for proof of flow, and line terminal block. Coil shall include an integral door interlock type disconnect switch, which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

C. Heaters shall be equipped with modulating control (Lynergy Comfort Controller (LCC) or equal) to control heater coil firing. The control panel shall include an interface to control heater coil firing in proportion to the EMCS signal. The EMCS signal shall connect to low voltage universal signal interface circuitry supplied and installed by the terminal manufacturer. The universal interface shall be selected for either 0-10 VDC or 0-20 mA interface options, without additional interface circuitry.

D. Discharge air temperature limit shall be provided through the modulating controller incorporating a downstream air temperature sensor. When invoked, the discharge air from the heater shall not exceed an adjustable maximum temperature setpoint.

2.7 FAN INTAKE FILTER

A. The filter shall be 1” thick, disposable construction type mounted in a rack on the fan air inlet and designed for ease of service.

B. Filter size shall be based on standard sizes that are readily available.

2.8 SOUND CRITERIA

A. Sound ratings for the terminals shall not exceed 40 NC in the occupied space at 1.0 inch w.g. inlet static pressure, and discharge static pressure of 0.25 inch w.g. NC estimations shall be calculated per AHRI 885, Appendix E. The terminal shall be provided with factory installed internal and external attenuators if sound requirements are not met. The external attenuator shall be shipped internal to the unit to protect it from shipping damage. The external attenuator shall be slid into the operation position and secured without the need for additional screws. Factory provided attenuators that require field installation are not acceptable.

2.9 CONTROLS AND SENSORS

A. The terminal shall mount the pressure independent electronic controls that are provided by Section 23 09 63.

B. The terminal unit shall incorporate a multi-point, center-averaging velocity sensor. A minimum of four measuring ports must be parallel to the takeoff point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03 in.w.g. at an inlet velocity of 500 fpm. The sensor must provide airflow control signal accuracy of ± 5%, with a hard 45° or 90° elbow attached directly to the inlet.

C. The terminal unit manufacturer shall provide, mount and wire fan relay, 24-volt transformer, and disconnect switch.

D. Flow measuring taps and flow curves shall be supplied with each terminal for field balancing airflow. Each terminal shall be equipped with labeling showing unit location, size, minimum and maximum cfm setpoints, damper fail position, QR code label as per submittal section, and thermostat action.

E. All electronic accessories, including switches for activation of fan shall be supplied and calibrated by the terminal manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Terminal units shall be installed with all required service clearances, according to manufacturer’s installation instructions.

B. Terminal units with electric heat shall be installed with clearance that meets NFPA 70.

C. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

D. Space limitation shall be reviewed carefully to ensure that all terminals will fit the available space.

E. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 23 37 13 - AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Ceiling air diffusers.
B. Wall registers and grilles.
C. Louvers.
D. Other air devices indicated on drawings and schedules.

1.2 RELATED SECTIONS

A. Section 08 91 00 - Louvers
B. Section 23 02 00 - Basic Materials and Methods for HVAC
C. Section 23 05 93 - Testing, Adjusting, And Balancing
D. Section 23 07 13 - DUCT INSULATION
E. Section 23 31 13 - Metal Ductwork
F. Section 23 33 00 - DUCTWORK ACCESSORIES

1.3 REFERENCES

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.
C. AMCA 540 - Test Method for Louvers Impacted by Wind Borne Debris; 2013.
D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.
E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
F. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
I. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2019).
J. ASTM D870 - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion; 2015.
K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Codes and Standards:

1. AHRI Compliance: Test and rate air distribution devices in accordance with AHRI 880 (I-P).
2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE Std 70.
3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500-L.
4. AMCA 540 - Test Methods for Louvers Impacted by Wind Borne Debris with Enhanced Protection Approval.
5. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.
6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
10. IBC - International Building Code.
11. IMC - International Mechanical Code.
12. UMC - Uniform Mechanical Code.

1.5 DEFINITIONS

A. Hurricane-prone regions:
   1. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed for Risk Category II Buildings is greater than 115 mph;
   2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

B. Wind-borne debris region: Areas within hurricane-prone regions located:
   1. Within 1 mile of the coastal mean high water line where the ultimate design wind speed is 130 mph or greater; or
   2. In areas where the ultimate design wind speed is 140 mph or greater. For Risk Category II buildings and structures and Risk Category III building and structures, except health care facilities, the wind-borne debris region shall be based on Figure 1609.3(1). For Risk Category IV buildings and structures and Risk Category III health care facilities, the wind-borne debris region shall be based on Figure 1609.3(2).

C. Ultimate design wind speed - The ultimate design wind speed for the determination of the wind loads shall be determined by Figures 1609.3(1), 1609.3(2) and 1609.3(3) of ICC (IBC).

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for the following:
   1. Air Distribution Devices
      a. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
      b. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.
      c. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
   2. Louvers
      a. Manufacturer's product data including performance data.
      b. Preparation instructions and recommendations.
      c. Storage and handling requirements and recommendations.
      d. Installation methods.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution device and louver, indicating materials, construction, dimensions, accessories, and installation details.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air distribution devices wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air distribution devices and louvers in original cartons and protect from weather and construction work traffic in accordance with manufacturer’s instructions. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 WARRANTY

A. Warrant the installation of the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - AIR DEVICES

A. Titus Company

B. Metalaire Industries, Inc.

C. Nailor Industries

D. Krueger

E. Price

2.2 AIR DEVICES

A. Unless otherwise indicated, provide manufacturer’s standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.

B. Provide air devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer’s current data.

C. Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50 inch-pound force applied.

D. Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.

E. Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screwdriver slot or a concealed lever operator for adjustment through the face of the air device.

F. Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled, one assembly per carton; each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.3 ACCEPTABLE MANUFACTURERS - LOUVERS

A. Ruskin Manufacturing Company

B. Greenheck Company

C. Louvers and Dampers, Inc.

D. Pottorff

E. Arrow

2.4 LOUVERS

A. Louvers not located in hurricane-prone regions or wind-borne debris regions shall meet the requirements of AMCA 500-L for Laboratory Methods of Testing Louvers for Rating and be drainable stationary type louvers.

B. Louvers located in hurricane-prone regions shall meet the requirements of AMCA 550 for High Velocity Wind Driven Rain without the use of a control damper.

C. Louvers located in wind-borne debris regions within 30 feet of grade shall meet the requirements of AMCA 540 for Large Missile Impact.

D. Provide louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

E. Provide louvers that have minimum free area and maximum pressure drop as indicated on drawings.

F. Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

G. Coordinate with Architect for finish and color.

H. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All interior surfaces of all air devices shall be painted flat black.

B. See floor plans for type, neck size and CFM of air for all air distribution devices.

C. Install all air distribution devices as detailed on plans and in accordance with manufacturer's recommendations.

D. The backside of all air devices shall be insulated with taped and sealed external duct wrap to match the insulation thickness and R-value of the ductwork connecting to the air device. Refer to 23 07 13 - DUCT INSULATION.

E. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

F. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

G. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

H. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

I. Louvers shall be provided with sheet metal plenum at the back of the louver. The plenums are to be welded or soldered and shall be watertight. Plenums shall be constructed with the bottom sloped toward the louver to allow wind-blown rain to drain out at the bottom of the plenum, through the louver to the building exterior. The plenum connection to the louver shall be watertight.

J. Touch-up, repair or replace any damaged products prior to substantial completion.

END OF SECTION

SECTION 23 41 00 - AIR FILTERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 - PRODUCTS

2.1 FILTERS

A. Air filters shall be 2 inch thick, high efficiency, consisting of synthetic media. Filter type shall be either throwaway pleated panel type or roll type filter media with frame as indicated below:
   1. Pleated panel filters shall consist of synthetic filter media with welded wire media support grid and beverage board enclosing frame.
   2. Roll type filters shall consist of synthetic media with metal lath media support grid and 24 gauge galvanized steel enclosing frame. Frames shall be sized to be the full height and width of the associated equipment for which the frames are being installed, one filter frame per unit or location. The frame shall be constructed to allow for frame disassembly in order to replace roll filter media.

B. APPROVED MANUFACTURERS
   1. American Air Filter.
   2. Camfil.
   3. Airguard Industries, Inc.
   4. Cambridge.
   5. Filtration Group

2.2 LOW VELOCITY FILTER SECTION

A. Filter section shall include a filter frame that accepts 2-inch thick filters. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter.

B. Filtering media shall be formed of non-woven reinforced synthetic type filtering media bonded to 96% open area media support grid. The filter pack shall be bonded to the enclosing frame to prevent air bypass. Filters shall include the specified Minimum Efficiency Reporting Value (MERV) when evaluated under the guidelines of ASHRAE Std 52.2. Filters shall carry MERV rating as follows:

1. MERV 8 for construction filters; initial resistance shall not exceed 0.21 inches water gauge at 500 FPM face velocity.
2. MERV 11 for final occupancy filters on recirculating systems; initial resistance shall not exceed 0.30 inches water gauge at 500 FPM face velocity.
3. MERV 13 for final occupancy filters on systems delivering ventilation air; initial resistance shall not exceed 0.30 inches water gauge at 500 FPM face velocity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Filters shall be provided upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to occupiable spaces per ASHRAE Std 62.1.

B. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inches w.g. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label.

C. Refer to Section 23 02 00 for additional filter information.

END OF SECTION

SECTION 23 52 16.13 - STAINLESS STEEL FIRE-TUBE CONDENSING BOILERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Vertical gas-fired condensing stainless steel fire tube hydronic heating boilers

B. Boiler venting

C. Controls and boiler trim

D. Fuel burning and combustion system

E. Circulator

F. Carbon monoxide detection system

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. Section 23 05 93 - Testing, Adjusting, And Balancing

D. Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 21 19 - Hydronic Specialties

G. Section 23 21 23 - HYDRONIC PUMPS

H. Section 23 51 00 - Breechings, Chimneys, and Stacks

1.4 REFERENCE STANDARDS

A. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2022.

B. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.

C. NFPA 54 - National Fuel Gas Code; 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Construct the boiler shell in accordance with the ASME Code for 160 psig working pressure. The boilers shall be inspected by an authorized inspector during construction.

B. Boiler shall be hydrostatically tested and registered with the "National Board of Boiler and Pressure Vessel Inspectors".
   1. Furnish 6 copies of the "Manufacturers' Data Report" for the boiler.

C. Boiler shall be approved as a unit by the CSA and bear the CSA label.

D. The burner, gas train and controls shall conform to the requirements of I.R.I./GE Gap

E. The boiler and installation shall conform to the Boiler Law Rules and Regulations of the Boiler Division of the Texas Department of Labor and Standards.

F. Provide factory tests to check construction, controls and operation of unit.
   1. Each boiler shall be completely assembled, wired, fire tested and preset to fire at its rating before leaving the factory.
   2. Provide a certificate of the factory fire test.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.8 SUBMITTALS

A. Submit data sufficient to show compliance with Contract Documents.

B. Product Data: Include boiler performance data, operating characteristics, furnished specialties, and accessories including venting products and accessories.

C. Shop Drawings: For boilers, boiler trim, and accessories, include plans, elevations, sections, details, and attachments to other work.

1.9 WARRANTY

A. The boiler manufacturer shall warrant parts and labor for each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start-up, whichever occurs first. Heat exchanger, pressure vessel, and fuel burner shall be warranted by the boiler manufacturer, parts and labor, for a period of ten (10) years from date of shipment.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.

6. Servicing and calibrating sensors associated with the carbon monoxide detection system.
7. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. RBI - Flexcore
B. Lochinvar - Crest
C. Raypak - Xvers

2.2 GENERAL

A. Each factory "packaged" boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.
B. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

2.3 PERFORMANCE CRITERIA

A. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 95% at full fire rate. Each boiler shall be capable of operating with a minimum outlet water temperature of 60°F.
B. Boiler heat exchanger shall be ASME BPVC-IV inspected and stamped and National Board registered for 160 PSIG maximum allowable working pressure and 200°F maximum allowable temperature, complete with a Manufacturer's Data Report.
C. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu. Ft. and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5 in.w.c. to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14 in.w.c.

2.4 BOILER DESIGN

A. Each hydronic heating boiler shall consist of a vertical, stainless steel heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.
B. Each boiler heat exchanger shall be full welded construction utilizing 316L stainless steel for the fire tubes, tube sheets, combustion chamber, flue collector and pressure vessel shell. The boiler water connections shall be flanged, 150 pound, ANSI 304AL stainless steel.
C. The heat exchanger shall be equipped with two lifting lugs welded to the top of the vessel to aid in rigging the unit for installation.

D. The formed structural steel base shall include properly sized openings for forklift from either side or a pallet jack from the front or rear of the unit.

E. A built-in flue gas test port must be included as a standard port of the heat exchanger flue collector.

F. The condensate collection basin shall be fully welded 316L stainless steel. The boiler shall include a condensate drain with float switch, which shall shut down the boiler if the condensate drain is blocked.

G. Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from a minimum 16 gauge carbon steel. The front and top wall shall be secured in place with ¼ -20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.

H. An observation port shall be located on the boiler to allow for observation of the burner flame.

I. Flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting (stack) as defined in NFPA 54, latest edition. Contractor must provide venting (stack) certified for installation on a Category IV appliance.

J. The boiler shall have as standard an internal, high capacity combustion air filter rated to MERV 8 (equal to or greater than 95% arrestance).

2.5 BOILER VENTING

A. Acceptable Manufacturers
   1. Duravent
   2. HeatFab
   3. Jeremias
   4. Metal-Fab

B. Boiler flue exhaust stack
   1. The flue (exhaust) stack shall be tested and listed to UL 1738/C-UL S636 approved for Category IV (condensing, positive pressure) applications as defined in NFPA 54, latest edition.
   2. The flue vent shall be of double-wall construction, with a minimum of 1” insulating air space. The inner wall shall be constructed AL 29-4C stainless steel and the outer wall shall be a minimum 304 stainless steel.
   3. The flue vent shall be factory-built type and shall be continuous from the appliance’s flue outlet to the vent termination outside the building. All system components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings shall be Intertek ETL and supplied from the same manufacturer.
   4. Joints shall be provided with flanged, overlapping mating surfaces and stainless-steel bands secured for appropriate sealing. Joints that do not utilize gasketing shall be provided with a high temperature rated sealant approved by the venting manufacturer both on the flange surface and at the securing bands. All sealant products shall comply with the UL listing for the venting system.
   5. Provide a flue vent adapter fitting to transition from the boiler flue collar to the flue vent stack as required by the venting manufacturer and boiler manufacturer.
   6. Provide a flue vent boot tee fitting with integral drain connection to transition the vent stack from horizontal to vertical with improved flue gas flow characteristics. The boot tee shall be installed at least 12” away from the connection at the boiler flue vent collar.

7. Provide a flue vent union fitting with an integral pluggable test port to allow easy access for performing flue gas analysis and for conducting tests for proper appliance operation without penetrating the vent wall.
8. Maximum flue gas temperature shall not exceed 550°F (288°C).
9. The flue vent shall be listed as an approved product for use with the boiler manufacturer. Compatibility with the boiler manufacturer shall be verified and documented.
10. Installation shall be in strict accordance with venting manufacturer and boiler manufacturer's installation instructions.

C. Boiler combustion air intake vent
1. The combustion air intake vent shall be 304 stainless steel and shall be tested and listed to UL 1738/C-UL S636.
2. The combustion air intake vent shall be of single-wall construction and shall be a minimum 304 stainless steel.
3. The combustion air intake vent factory-built type and shall be continuous from the appliance's air intake connection to the vent termination outside the building. All system components such as vent supports, roof or wall penetrations, terminations and appliance connectors shall be Intertek ETL and supplied from the same manufacturer.
4. The combustion air intake vent shall be listed as an approved product for use with the boiler manufacturer. Compatibility with the boiler manufacturer shall be verified and documented.
5. Installation shall be in strict accordance with venting manufacturer and boiler manufacturer's installation instructions.

2.6 BOILER TRIM

A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:
1. Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to acceptable drain.
2. Water pressure-temperature gauge.
3. Primary low water flow fuel cutoff (probe type with manual reset).
4. Manual reset high limit water temperature controller.
5. Operating temperature control to control the sequential operation of the burner.
6. Separate inlet and outlet water temperature sensors capable of monitoring flow
7. Exhaust temperature sensor
8. Flow meter factory installed to provide on-screen flow rate.

2.7 BOILER FUEL BURNING SYSTEM

A. The combustion chamber shall be of the sealed combustion type employing a high temperature stainless steel knitted mesh burner, mounted in a vertical orientation.

B. The burner must be capable of firing both a complete blue flame with maximum gas and air input as well as firing infrared when gas and air are reduced. The burner must be capable of firing at 100% of rated input when supplied with 4.0 in.w.c. of inlet gas pressure, so as to maintain service under heavy demand conditions.

C. The burner shall use a fully sealed, non-sparking combustion air blower to precisely mix and control the flow of fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.

D. The blower shall vary its output in response to a pulse width modulation signal supplied directly from the modulating temperature control, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion.

2.8 MAIN GAS VALVE TRAIN

A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:
   1. The boiler(s) shall have a firing/leak test valve and pressure test valve as required by CSD-1.
   2. The boiler(s) shall have dual-seated main gas valve.
   3. Gas control trains shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13.
   4. A gas sediment trap with flanged connection shall be included as a standard on the gas line connection point to the boiler.

2.9 IGNITION SYSTEM

A. Each boiler(s) shall be equipped with a 100% safety shutdown.

B. Ignition shall be proven Hot Surface Ignition (HSI) type with full flame rectification by remote sensing separately from the ignition source or spark ignition device with a spark generator. A three-try-for-ignition sequence is standard.

C. The igniter will be oriented vertically to extend the life of the igniter.

D. The ignition control module shall include an LED display that indicates fifteen (15) individual diagnostic flash codes and transmits any faults to the touchscreen display.

E. An external viewing port shall be provided, permitting visual observation of burner operation.

2.10 BOILER CONTROL SYSTEM

A. The following safety controls shall be provided:
   1. High limit control with manual reset, mounted and wired.
   2. Flow switch, mounted and wired.
   3. Low water cut-off with manual reset, mounted and wired.
   4. Blocked vent pressure switch, mounted and wired.
   5. Blocked condensate switch, mounted and wired.

B. The boiler(s) shall be equipped with the following:
   1. Modulating temperature controller with 7” capacitive color touchscreen display.

2.11 BOILER OPERATING CONTROL SYSTEM

A. Remote Monitoring Connectivity:
   1. The controller shall include the Remote Monitoring connectivity feature to allow remote access to boiler or water heater data, and to provide maintenance reminders and error notifications on iOS and Android devices or by website access.
   2. The Remote Monitoring system allows for registering of multiple devices at various locations and multiple devices in a single cascade installation. The system also allows separate Groups to be established with various levels of access and control permission to be set by the equipment owner. The Groups feature will also allow for quick and efficient troubleshooting service by the local manufacturer’s representative service team.
   3. Remote Monitoring system will provide reminders and alerts via iOS or Android notification, text, or email. All notification features are user set.
   4. The Remote Monitoring System’s app and website will allow remote monitoring of the following:
      a. Outlet and inlet temperature monitoring

b. Vent temperature
c. Flow (if equipped)
d. Blower speed
e. Modulation percentage
f. Flame current
g. Run time
h. Boiler Status
i. Cycles
j. Historical data

5. The Remote Monitoring System's App and Website will allow remote control of the following:
   a. Temperature setpoint
   b. Temperature differential
   c. Outdoor Reset settings
   d. Indirect Setpoint
   e. Indirect differential
   f. Custom notification
   g. Full historical data reports will be available for review on the Remote Monitoring System's website.
6. One (1) year of Remote Monitoring service is included with boiler purchase.

B. Each boiler shall have the ability to receive a 0 to 10 VDC signal from the energy management and control system (EMCS) to vary the set point. Each boiler shall have an alarm contact for connection to the EMCS.

C. Each boiler shall be equipped with BACNET communications compatibility with up to 146 points of data available.

D. System cascade sensor and optional air temperature sensor shall be shipped loose for field installation by installing contractor. Inlet, outlet, flue gas, and water flow rate sensors are factory-installed.

E. Control system shall be capable of controlling the boiler pump.

F. The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:
   1. One (1) burner "on-off" switch.
   2. One (1) electronic combination temperature control, flame safeguard and system control.
   3. Control circuit breaker, 5 amp
   4. All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.
   5. Touch screen Display Panel to adjust set points and control operating parameters. Touch screen display to indicate burner sequence, all service codes, fan speed, boiler set point, sensor values such as inlet, outlet, flue gas and outdoor air.

G. The package boiler manufacturer shall supply a boiler master/member network control system integral to each boiler(s). The functions of this controller shall be capable of sequencing all major equipment in the hot water boiler plant as indicated on the Documents and Drawings. The controller shall interface to the EMCS.

H. The control system shall have the capability of sequencing all boilers that operate as part of the hydronic heating boiler plant, including all condensing and non- condensing boilers as scheduled on the drawings. Control system to be able to control boiler circulation pump(s) or isolation valves (if required) and system pump(s). Control system shall also be capable of EMCS communications, and outdoor reset functions for total system efficiency optimization.

I. The integrated control system shall provide complete boiler plant coordinated firing rate, sequence each boiler in order to maintain hot water temperature at supply or return setpoint without short cycling the boilers. Additionally, each control shall provide operator manual over-ride control to start, stop and set individual boiler firing rate.

J. The control system must include edit menus, fault history, alarm and event summaries for system setup and troubleshooting.

2.12 FACTORY TESTING - HYDROSTATIC

A. Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME “H” stamp.

2.13 FACTORY TESTING - FIRE TESTING

A. Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

2.14 CIRCULATOR

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psig (860 kPa) maximum working pressure.

B. Casing: Cast iron.

C. Impeller: Cadmium plated steel, keyed to shaft.

D. Bearings: Two, oil lubricated bronze sleeves.

E. Shaft: Alloy steel with copper sleeve, integral thrust collar.

F. Seal: Carbon rotating against a stationary ceramic seat, 225 degrees F (107 degrees C) maximum continuous operating temperature.

2.15 CARBON MONOXIDE MONITORING SYSTEM

A. Provide carbon monoxide detection system at each boiler room.

B. Approved Manufacturers:
   1. Honeywell
   2. Sensidyne
   3. American Gas Safety
   4. Kele
   5. US Draft Co.

C. Carbon monoxide detection system shall be manual reset type and shall be interlocked with the boiler(s) to disable the boiler burners when the concentration of carbon monoxide in the room exceeds 50 ppm.

D. Upon a loss of power to the detection system or associated sensors, the boiler burners shall be disabled.

E. The carbon monoxide detection system shall be installed as required by Texas Department of Licensing and Regulation Boiler Rules 65.206.

F. The carbon monoxide detector shall have the capability of calibration every 18 months with a certification issued as a record of calibration.

G. Emergency signs shall be provided at any room with carbon monoxide detection. Signs shall include a warning that the visual and audible alarms indicate a carbon monoxide leak has been detected and the monitored area should be evacuated. Sign material shall be engraved, laminated, UV resistant plastic or etched metal with self-adhesive backing. Submittals shall include sign material, dimensions, color, lettering format, and warning message for approval.

H. Refer to Sequence of Operations on the mechanical control diagrams for further information.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install where shown on the Drawings. Follow manufacturer's instructions.

B. Install equipment in strict compliance with manufacturer's installation instructions.

C. Install equipment in strict compliance with state and local codes and applicable NFPA standards.

D. Maintain manufacturer's recommended clearances around sides and over top of equipment.

E. Provide all electrical control and power interconnect wiring in compliance with NFPA 70.

F. Provide all flue gas vent and service piping. Boiler(s) will require Category IV vent material. Boiler requires an exit cone vent termination, not a stack cap.

G. Provide all piping for boiler pipe connections.

H. Provide each boiler with an acid neutralization kit manufactured by JJM or approved equal. The neutralization kit shall be sized for the maximum capacity of the associated boiler. Install acid neutralizer per manufacturer’s installation instructions.

I. Contractor shall route drain lines from the boiler condensate drain connection and flue vent drain connection to the acid neutralization kit. Provide drain traps at each drain line to prevent positively pressured flue gas from escaping into the surrounding boiler room. The drain lines shall be the same size as the connection at the boiler or vent drain connection and shall not decrease in size from the drain connection to the place of condensate disposal. Drain piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1-percent slope Boiler and flue vent drain line material shall be acid-resistant PVC or another corrosion-resistant material recommended by the equipment manufacturer. All drain piping associated with the boiler and flue vent shall be installed as indicated in the boiler manufacturer’s installation instructions.

J. Emergency signs shall be installed outside each exit door to rooms provided with carbon monoxide monitoring. Install signs where they can be easily seen. Coordinate final locations with the Architect and Owner prior to installation.

3.2 OPERATION TESTS

A. Do not start boiler until entire heating water systems is cleaned, flushed, and accepted by the Owner.

B. Controls: At the time the boiler is ready to be placed in operation, make a check of the proper operation of all controls, including safety controls and relief valve.

C. Contractor shall perform a functional test of the carbon monoxide monitoring system. Test shall simulate an alarm condition and demonstrate the functionality of the system to disable the associated appliances and alarm the building EMCS as required.

D. Efficiency: Run a flue gas analysis to determine the following at both high and low fire.
   1. Establish minimum efficiency of 95%
   2. CO2, O2, CO, NOx (corrected at 3% O2), Stack Temperature
   3. Stack pressures

E. Boiler manufacturer and mechanical contractor to coordinate with BAS contractor that the boiler system is functioning as designed.

F. Report: Upon completion of the above tests, submit a report certifying proper operation.

END OF SECTION

SECTION 23 62 13 - AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment; 2022.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 QUALITY ASSURANCE

A. Unit shall be factory tested, shall be UL-labeled and rated in accordance with AHRI 340/360 (I-P).

B. Unit construction shall comply with ASHRAE Std 15.

C. Unit wiring shall comply with NFPA 70.

D. Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 SUBMITTALS

A. Submit Shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and accessories required for complete system.

C. Product data shall include rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D. Submit manufacturer's installation instructions.

E. For roof mounted units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation data.

B. Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C. Submit maintenance data.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B. Accept products on site and inspect for damage.

C. Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.8 WARRANTY

A. Provide the entire condensing unit with parts, labor, and refrigerant warranty by the equipment manufacturer for five years from the date of substantial completion.

B. All components replaced through the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 AIR-COOLED CONDENSING UNITS

A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit and rated in accordance with either AHRI 210/240 or AHRI 340/360 (I-P). Capacity shall be as called for on the Drawings when matched to the appropriate evaporator coil.

B. Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, R-454B or R-32 refrigerant and refrigeration circuit and valves.

C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be mounted on resilient rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

E. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

F. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

G. Power connections shall be made to the connectors located inside the electrical connection box.

H. Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.

2.2 AUXILIARY EQUIPMENT

A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.

C. Expansion valve shall be provided with the evaporator coil.

D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E. Provide polyethylene structural base designed for that service, and intended to support the unit and eliminate vibration transmission.

F. Provide hard-start kit with unit.

G. Provide hail guards for condenser coils.

2.3 ACCEPTABLE MANUFACTURERS

A. Carrier

B. York/JCI

C. Daikin

PART 3 - EXECUTION

3.1 INSTALLATION

A. All HVAC equipment shall be installed as per manufacturer’s printed installation instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer’s requirements.

D. Install the condensing unit on proper foundation as shown on the Drawings, and in location that will not restrict the air entry or discharge from the unit.

E. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC sleeve for protection.

F. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.2 TESTING

A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B. Read and record the power draw and the refrigeration suction and liquid pressures as required by Section 23 05 93 - Testing, Adjusting, And Balancing.

END OF SECTION

SECTION 23 64 16 - CENTRIFUGAL WATER CHILLERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. AHRI 550/590 (I-P) - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

C. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

D. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

C. Verify unit voltage matches voltage on electrical drawings.

D. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

E. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

F. Submit manufacturer's installation instructions including: Power, power wiring requirements, control wiring requirements, insulation details for unit motor starter details, etc.

G. Performance Data - Submittal shall include chiller manufacturer's computer generated performance ratings. These computer ratings shall be certified in accordance with AHRI 550/590 (I-P). Computer ratings shall also contain AHRI Certified part load values for operation at 100%, 75%, 50%, and 25% of full load with 2.5 degree F reduction in entering condenser water temperature per every 10% reduction in load. The chiller manufacturer shall guarantee that the chiller will maintain stable operation with variable evaporator water flow rate and at the resulting entering condenser water temperatures for these four (4) load points and at 15% of full load with reduced ECWT as stated above.

H. Power required at 25, 50, 75, and 100% of rated equipment capacity shall be submitted for evaluation.

I. Supporting documentation certifying internally enhanced condenser tubes if provided may be cleaned by conventional means.

1.6 WARRANTY

A. Provide ten (10) year warranty for all machine parts, labor and refrigerant for chiller package. All components replaced via the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment. All warranty work shall be performed by factory direct service technician, not the project mechanical contractor. During warranty phase, provide quarterly inspections (4 per year) by factory direct technician. Provide at least one week notice to owner to schedule service. All warranties shall begin upon project substantial completion, no exceptions.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 DESIGN CHANGES

A. The design and layout shown on the drawings are based on the manufacturer shown in the equipment schedule. If equipment other than that of the manufacturer shown is submitted to the engineer for consideration as an equal, it shall be the responsibility of the bidder wishing to make the substitution to submit with the request a revised drawing of the mechanical room layout acceptable to the engineer. This revised drawing shall show the proposed location of the substitute unit and the area required to pull the tubes, compressor, and motor. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.

B. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.

2.2 CHILLER

A. Chiller shall consist of motor, compressor, evaporator (cooler), condenser, purge unit, isolation assembly, machine control center, and starter, with the controls for automatic operation mounted on the chiller.

B. Chiller shall be a fully packaged unit complete in all details to chill fluid shown on drawings in quantities indicated from and to the temperature shown, when supplied with condenser water quantity indicated and with a rise from 86 degree F to 96 degree F unless otherwise indicated on the equipment schedule. Capacity shall be no less than that noted in the schedule on the drawings.

C. Chiller shall meet the minimum efficiency standards required by ICC (IECC) and ASHRAE Std 90.1 I-P.

D. Unit power required shall not exceed that shown on the drawings in kW/ton at full load design conditions. Unit full and part load power shall include all electrical losses in the variable frequency drive and harmonic filtration. Unit efficiency shall not exceed either full or part load efficiencies listed on the equipment schedules.

E. Pressure drop through evaporator and condenser shall not exceed that shown on the drawings. Units submitted having less pressure drop than shown on the drawings are encouraged but should be called to the attention of the engineer.

F. Chiller shall be shipped factory-assembled with all refrigerant piping and control wiring factory-installed.

G. Chiller shall use refrigerant R-1233zd or R-513A and shall comply with ASHRAE Std 15.

H. Provide positive metering of the refrigerant flow in the machine. Chiller shall be capable of operating with entering condenser water of 60 degree F, or a cooling tower bypass valve, controls, and associated piping shall be provided by the contractor, whether shown on the drawings or not.

2.3 COMPRESSOR AND DRIVE

A. Motor and compressor shall be hermetically sealed into a common assembly for direct driven units.

B. Compressor shall be single-stage with hot gas bypass or multiple stage with an interstage economizer. Impellers shall be overspeed-tested to 20% above operating conditions at the factory.

C. Compressor motor shall be cooled by sub-cooled liquid refrigerant in intimate contact with all internal motor components. Motor starter shall be arranged for service with only minor compressor disassembly and without requiring the breaking of main refrigerant piping connections.

D. For Direct Drive Units: Compressor wheel(s) shall be mounted on the motor shaft and supported by the motor bearings. Motor speed shall be 3,600 rpm.

E. For Gear Drive Units: Transmission gears shall be double helical type, arranged to allow visual inspection without disassembly or removal of the compressor casing or impeller.

2.4 LUBRICATION SYSTEM

A. Lubrication system shall be factory-installed to deliver oil under pressure to all bearings. System shall consist of hermetic motor-driven oil pump, with starter and controls, oil cooler, pressure regulator, oil filter, automatic water control valve, thermostatically controlled oil heater, and oil reservoir with temperature gauge.

2.5 COOLER AND CONDENSER

A. Cooler and condenser shall be separate shell and tube vessels with ASME BPVC-VIII-1 stamp where applicable.

B. Tubes shall be integrally finned copper tubing rolled into tube sheets and support sheets and individually replaceable. Pipe connections and water boxes shall be designed for 150 psig (1035 kPa) unless noted otherwise and shall be provided with vents and drains. Provide tappings in water boxes or adjacent piping for control sensors, gauges, and thermometers. Minimum tube thickness shall be 0.028".

2.6 PURGE SYSTEM

A. Purge system shall be furnished for chillers operating under a vacuum.

B. Purge system shall be self-contained compressor type with necessary devices for evacuating air and water vapor and with means of separating the refrigerant and returning it to the system.

C. If other types of purge systems are proposed, all changes in piping and wiring shall be noted in the submittal, as required in 2.1 of this Section of the Specifications.

D. Vent purge unit to outdoors.

2.7 CONTROLS

A. Controls shall be solid-state, fully automatic, and fail-safe. The chiller shall shut down in the event of motor overcurrent, high bearing temperature, high condenser pressure, high motor temperature, and low oil pressure. Each of the above controls shall have an individual manual reset.

B. Provide a leaving chilled water low-temperature shutdown with automatic reset.

C. Provide a low-limit, manual reset, freeze protection thermostat in the leaving chilled water.

D. Provide devices to limit current draw to full-rated amps. Provide demand-limiting device so that maximum current may be set between 40 and 100% of full load.

E. Capacity control shall modulate the capacity from 100 to 10% of full load (AHRI conditions) without the use of hot gas bypass.

F. Controls shall be factory-prepiped and factory-prewired to terminal strips where interlocks to other equipment can be easily field-connected. Terminals and wires shall be individually identified.

G. Controls shall include a program timer to ensure prelube and postlube needs prior to start and during coast-down (under power for power failure conditions). The control shall prevent restart for a field-adjustable time period.

H. Controls shall prevent compressor from short cycling under any circumstances.

I. Provide chiller with BACnet interface for integration into an Energy Management and Control System (EMCS) for monitoring of Chiller operations. BACnet interface shall be BACnet certified. Chiller microprocessor must be capable of receiving an EMCS input signal for Remote Run/Stop and Leaving Chilled Water Temperature Reset.

2.8 SUPPORTS

A. Chiller manufacturer shall furnish soleplates and isolation pad assembly for mounting and leveling chiller on concrete base.

B. Spring-type isolators shall be provided for chillers not installed on a grade-supported concrete base. Isolators shall be selected by the chiller manufacturer for the conditions involved to prevent noise and vibration transmission to the structural frame.

2.9 INSULATION

A. The evaporator (cooler), the suction elbow between the compressor and the evaporator, and the cooler water box covers shall be factory-insulated.

B. All small water piping and incidental items shall be field-insulated.

C. Insulation shall be closed-cell, foamed, fireproof plastic, 3/4 in. thick with thermal conductivity as recommended by manufacturer to prevent condensation on the surface.

2.10 ELECTRICAL SYSTEM

A. Variable Speed Drive
   1. Chiller shall be provided with a variable speed drive (VSD) with circuit breaker, disconnect switch with external lockable handle, and minimum short circuit current rating of 65,000 AIC. The VSD shall be factory mounted on the chiller and shipped completely factory assembled, wired and tested.
   2. Drive shall be solid state, microprocessor-based, pulse-width modulation (PWM) type utilizing insulated-gate bipolar transistor (IGBT) output power devices with a power factor of 0.95 or better at all loads and speeds. VSD full load efficiency shall meet or exceed 97% at 100% VSD rated ampacity.
   3. Provide VSD with integral 5% impedance line reactor or DC link filter to reduce the harmonics to the power line and to add protection from AC line transients. VSD voltage total harmonic distortion (THD) and harmonic current total demand distortion (TDD) shall not exceed 35%.
   4. The VSD shall be refrigerant cooled, closed loop water cooled, or air cooled. VSD enclosure cooling shall be microprocessor controlled to maintain temperature within acceptable limits for the VSD enclosure.
   5. The VSD controls shall automatically regulate compressor speed and inlet guide vanes to optimize chiller efficiency over all chiller operating conditions while avoiding surge. Movable inlet guide vanes and variable compressor speed shall provide chiller unloading.

6. Surge prevention and surge protection algorithms shall take action to prevent surge and move chiller operation away from surge.
7. The VSDs shall each be furnished in a pre-painted, unit mounted, metal enclosure having a minimum short circuit withstand rating of 65,000 amps per UL 508A. It will include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory installed bus bars and all components properly segregated and completely enclosed in a single metal enclosure.
8. Chiller manufacturer shall furnish control wiring diagrams for the installation of chiller and associated equipment.
9. Drive shall be suitable for continuous operation at nameplate voltage ±10%. Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 5 seconds.
10. Drive shall be suitable for operation in ambient temperatures between 32 and 104°F, 95% humidity (non-condensing) for altitudes up to 3,300 ft above sea level without derating.
11. Drive shall comply with applicable ANSI, NEMA, UL and NEC standards.
12. A single display shall provide interface for programming and display of VSD and chiller parameters. Viewable parameters include:
    a. Operating, configuration and fault messages
    b. Frequency in Hz
    c. Load and line side voltage and current (at the VSD)
    d. kW (line and load side)
    e. IGBT temperatures
13. VSD shall have a control power transformer that provides power to VSD controls and chiller controls. The refrigerant pump fuse, purge unit fuse, purge unit control power, and control power transformer shall be factory wired.
14. The following 115V discrete contact outputs shall be provided for field wiring:
    a. Chilled water pump
    b. Condenser water pump
    c. Alarm status
    d. Tower fan on
    e. Tower fan off
15. The following protections shall be supplied:
    a. Under-voltage
    b. Over voltage
    c. Over current
    d. Phase loss
    e. Phase reversal
    f. Ground fault
    g. Phase unbalance protection
    h. Single cycle voltage loss protection
    i. Programmable auto re-start after loss of power
    j. Motor overload protection (NEMA Class 10)

2.11 FOULING FACTORS

A. Condenser - 0.00025; Cooler - 0.0001, AHRI 550/590 (I-P) ratings.

2.12 ACCEPTABLE MANUFACTURERS

A. Chillers shall not be part of the base bid. Chillers shall be provided under alternate. Refer to 01 23 00 Alternates.

B. All materials and labor costs to coordinate, receive, install and start-up the equipment for a complete and operating system shall be included in the base bid.

C. Acceptable manufacturers shall be as follows
   1. Carrier
   2. JCI/York
   3. Daikin

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall set the chiller in place as shown on the submittal drawings and in such a position that all tubes, compressor, and motor can be pulled and removed from the equipment room.

B. The contractor shall install, and leave in place, necessary rigging to lift the motor and compressor. The rigging shall be supported by structural members of adequate size, or sufficient members shall be provided.

C. The chiller shall be set level on soleplates or isolators as required above.

D. Piping connections for chilled fluid, condenser water, and miscellaneous small piping required shall be installed as shown on the drawings and as recommended by the manufacturer. Note that piping to the unit shall provide for removal and replacement for the servicing of the equipment by the use of flanges, couplings, etc.

E. The chiller starter and related pump motor starters shall be mounted, wired for power, and interlocked with the controls.

F. Flow or pressure differential switches shall be provided in the chilled liquid and in the condenser water circuits as recommended by the manufacturer.

G. Power wiring shall be provided for the oil pump starter, oil heater, purge unit, and other equipment requiring power. This power shall be independent of the main compressor starter.

H. Provide small water piping for the oil cooler and any other equipment required. Provide drain and vent connections for all water connections.

I. Provide refrigerant pressure relief vent piping as required. Extend vent piping from each chiller relief device connection to the outdoors without valves or restrictions. Install vent piping per the chiller manufacturer’s installation instructions. Relief vent piping shall be constructed of schedule 40 galvanized steel pipe. Cover the pipe termination with stainless steel bird screen.

J. Install thermometers and gauges as recommended by the chiller manufacturer and as shown on the drawings

K. Units provided with low pressure refrigerant shall also be provided with the following for the mechanical room: Adequate mechanical ventilation, refrigerant monitors and alarms to maintain safe operating conditions for plant operators. The monitors, ventilation and alarms shall be provided within this contract. The guidelines established in ASHRAE Std 15 and ASHRAE Std 34 shall be followed. All electrical requirements shall be provided.

L. If scheduled chiller is direct driven and located within an air conditioned room the air conditioning equipment has been sized for a direct driven chiller. If the contractor installs an open drive chiller the cooling capacity of the equipment shall be increased (at no cost to the owner) to handle the additional heat gain.

3.2 START-UP AND TESTING

A. The chiller manufacturer shall provide the services of a factory-trained engineer to check the installation and report to the contractor and the engineer any changes required in the installation to ensure proper operation and servicing of the chiller. Changes recommended by the start-up engineer shall be made as soon as recommended so as to avoid delay in the use of the equipment. This review and necessary changes shall be at the contractor's expense.

B. After the equipment installation has been checked, the start-up engineer shall check out the equipment. If all factory wiring, etc., is in order, the chiller shall be charged as necessary and placed in service.

C. The operation of the chiller shall be observed and all safeties set and checked for proper operation.

D. The refrigerant pressure, water pressure, water flow, temperature, and power shall be read, recorded and submitted to the owner as required under Section 23 05 93 - Testing, Adjusting, And Balancing.

E. The start-up engineer shall submit a full report to the contractor, engineer, and owner confirming the system was thoroughly checked and placed in service. This report shall include the items required above. Verbal comments and reports should not be directed to the owner, or the owner's representative, unless contractor and engineer are present.

3.3 TRAINING

A. The contractor and the manufacturer's engineer shall provide full sets of parts and operating instructions to the owner's operating personnel.

B. These persons shall be fully briefed in the normal start-up of the system, operation under light load and full load, and normal and emergency shutdown of the chiller and associated equipment.

C. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented by written instructions.

D. Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the start-up report.

END OF SECTION

SECTION 23 64 26 - ROTARY SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. AHRI 550/590 (I-P) - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

E. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

H. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

C. Verify unit voltage matches voltage on electrical drawings.

D. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

E. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

F. Submit manufacturer's installation instructions including: Power, power wiring requirements, control wiring requirements, insulation details for unit motor starter details, etc.

G. Performance Date - Submittal shall include chiller manufacturer's computer generated performance ratings. These computer ratings shall be certified in accordance with AHRI 550/590 (I-P). Computer ratings shall also contain AHRI Certified part load values for operation at 100%, 75%, 50%, and 25% of full load with 2.5 degree F reduction in entering condenser water temperature per every 10% reduction in load. The chiller manufacturer shall guarantee that the chiller will maintain stable operation at the resulting entering condenser water temperatures for these four (4) load points and at 15% of full load with reduced ECWT as stated above.

H. Supporting documentation certifying internally enhanced condenser tubes if provided may be cleaned by conventional means.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

C. Include instructions on where and how to contact local service and parts centers.

D. Include description and setpoints of controls.

1.6 QUALITY ASSURANCE

A. Unit construction shall comply with UL 1995, NFPA 70 and ASME applicable codes (U.S.A. codes).

B. Conform to AHRI 550/590 (I-P) code for testing and rating of rotary screw chillers.

C. Conform to ASME BPVC-VIII-1 Boiler and Pressure Vessel Code for construction and testing of chillers.

D. Conform to ASHRAE Std 15 code for construction and operation of chillers.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

D. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.8 WARRANTY

A. Provide ten (10) year warranty for all machine parts, labor and refrigerant for chiller package. All components replaced via the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment. All warranty work shall be performed by factory direct service technician, not the project mechanical contractor. During warranty phase, provide quarterly inspections (4 per year) by factory direct technician. Provide at least one week notice to owner to schedule service. All warranties shall begin upon project substantial completion, no exceptions.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chillers shall not be part of the base bid. Chillers shall be provided under alternate. Refer to 01 23 00 Alternates.

B. All materials and labor costs to coordinate, receive, install and start-up the equipment for a complete and operating system shall be included in the base bid.

C. Acceptable manufacturers shall be as follows
   1. JCI/York
   2. Daikin
   3. Carrier

2.2 MANUFACTURED UNITS

A. Provide factory assembled and tested, packaged, water cooled, liquid chillers consisting of rotary screw compressors, compressor motor, condensers, evaporator, refrigerant charge of R-513A, refrigeration accessories, instrument and control panel including gauges and indicating lights, auxiliary components and accessories, and motor starters. Construction and ratings shall be in accordance with AHRI 550/590 (I-P).

B. Units shall have Energy Efficiency Rating (EER) not less than prescribed by ICC (IECC) and ASHRAE Std 90.1 I-P.

2.3 COMPRESSORS

A. Open Drive Units
   1. Motor shall be two-pole, continuous duty, squirrel cage, induction type motor, and shall have an open drip proof enclosure (totally enclosed fan cooled motor if exposed to moisture). Motor full load amps shall not exceed either the motor nameplate amps or the amps corresponding to KW specified on the schedule.
   2. Motor design shall be such to allow standard connection to the type starter specified. Motor shall be factory mounted.
   3. A structural steel bracket between the compressor and the motor shall be furnished to maintain factory alignment.
   4. The compressor shall be an open drive, rotary screw type. The compressor housing shall be of cast iron, precision machined to provide minimal clearance for the motors. The rotors shall be manufactured from forged steel and use asymmetric profiles operating at a maximum speed of 3600 RPM

5. Capacity control shall be achieved to provide fully modulating control from 100% to 15% of full load. Compressors must start unloaded for soft start on motors.
6. The unit shall be capable of operating with lower temperature cooling tower water during part load operation in accordance with AHRI 550/590 (I-P). To maximize part load efficiency the unit must be able to sustain continuous operation with the entering condenser water temperature as low as 15 degree F above the leaving chilled water temperature.

B. Direct Drive Units:
1. Construct semi-hermetic helical rotary screw compressors with rotors of high grade steel or cast iron alloy. Screw compressor shall be of horizontal design and shall have both a male and a female rotor.
2. Statically and dynamically balanced rotating parts.
3. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
4. Provide compressor with automatic capacity reduction equipment to provide fully modulating control from 100% to 15% of full load.
5. Provide compressor motors for maximum speed of 3600 RPM, suction gas cooled with solid state sensor and electronic winding overheating protection. Compressor motor power factor shall be 0.95 or greater. If the compressor motor power factor is less than 0.95, power factor correction capacitors must be installed.
6. The unit shall be capable of operating with lower temperature cooling tower water during part load operation in accordance with AHRI 550/590 (I-P). To maximize part load efficiency the unit must be able to sustain continuous operation with the entering condenser water temperature as low as 15°F above the leaving chilled water temperature.

2.4 LUBRICATION

A. An adequate supply of oil shall be available to the compressor at all times by pre-lube and post lube oil pump operation. During operation, oil shall be delivered by positive system. An oil reservoir shall be located in the compressor to lubricate bearings in the case of a power failure.

B. An immersion oil heater shall be provided, temperature actuated to effectively remove refrigerant from oil. An external replaceable - cartridge, oil filter shall be provided, along with manual isolation stop valves for ease of servicing. An oil filter differential pressure gauge shall be included to aid in scheduling filter change. An oil eductor shall be provided to automatically remove oil which may have migrated to the evaporator and return it to the compressor. The oil separator shall be of a horizontal design with no moving parts, and shall provide effective oil separation before the refrigerant enters the heat exchangers. A refrigerant cooled oil cooler shall be provided to allow operation of chiller over the full range of operating conditions. A water oil cooler may be utilized only if it is a cleanable type.

2.5 EVAPORATOR AND CONDENSER SHELL ASSEMBLIES

A. Evaporator and condenser shall be the shell and tube type designed for 300 psig working pressure on the refrigerant side and be tested at 450 psig. Shells shall be fabricated from rolled carbon steel plate with welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four (4) feet apart.

B. The refrigerant side shall be designed, tested and stamped in accordance with ASME BPVC-VIII-1.

C. Tubes shall be individually replaceable.

D. Both shells shall have relief devices to meet the requirements of ASHRAE Std 15.

E. Water boxes shall be removable. Stubout water connection having Victaulic grooves or flanged connections shall be supplied.

F. Water side of shells, include water boxes, shall be designed for 150 psig design working pressure and be tested at 225 psig.

G. Vent and drain connections with plugs shall be provided on each water box.

2.6 REFRIGERANT SYSTEM

A. Refrigerant flow to the evaporator shall be metered by a single fixed orifice with no moving parts.

B. The condenser flow to the evaporator shall be metered by a single fixed orifice with no moving parts.

C. The condenser shell shall be capable of storing the entire system refrigerant charge during servicing. Isolation from the rest of the system shall be by manually operated isolation valves located at the inlet and outlet of the condenser. Additional valves shall be provided to facilitate removal of refrigerant charge from the system.

2.7 UNIT CONTROL PANEL

A. Each unit shall be furnished complete with a micro-computer control center in a locked enclosure, factory mounted, wired, and tested.

B. The control center shall include a touch key pad mounted on the front of the control center which allows the operator to display system operation parameters on a multi-character alphanumeric display that is part of the key pad. These operation parameters include:
1. Chilled water temperatures - leaving and return.
2. Refrigerant pressures - evaporator and condenser.
3. Differential oil pressure at oil filter.
4. Condenser water temperature - leaving and return.
5. Discharge temperature.
6. Three phase volts and three phase amps.
7. Elapsed time meter and number of compressor starts.
8. Oil pressure at compressor.

C. The system setpoints shall be operator entered on the front control center key pad. The setpoints shall be displayed on the multi-character alphanumeric display. The system setpoints shall include:
1. Chilled water temperature (LCHWT).
2. Current Limit

D. Any input that potentially harms the machine shall be rejected and the operator shall be advised via display message.

E. The cause of all system shutdowns (safety or cycling) shall be preserved (until the system is reset or restarted) in the microcomputer's memory for subsequent viewing on the alphanumeric display. The operator shall be continuously advised of system operating conditions by various background and warning messages. The key pad shall contain special service passwords for use by service technicians when performing system troubleshooting.

F. All safety controls shall be annunciated through the alphanumeric display consisting of day, time of shutdown, cause of shutdown, and type of restart required. Safety controls with automatic unit shutdown shall be provided for:
1. Sensor malfunction.
2. Low oil pressure at compressor.
3. High and low refrigerant pressure.

4. Low chilled water temperature.
5. High oil temperature.
6. Starter fault.
7. Unit shall not start without minimum flow through the evaporator or the condenser.

G. Field interlocks shall be provided to differentiate between cycling and safety shutdown. Separate contact closure shall also be furnished to indicate chiller will start (all safeties and cycling devices satisfied) when a remote start signal is received.

H. Chilled water flow detection devices shall be provided to shutdown unit when flow drops below minimum. Devices shall be mounted in a horizontal section of pipe where there is a straight run of at least five pipe diameters on each side of the flow switch.

I. Provide chiller with BACnet interface for integration into an Energy Management and Control System (EMCS) for monitoring of chiller operations. BACnet interface shall be BACnet certified. Chiller interface with EMCS shall include at a minimum:
1. Remote start.
2. Remote stop.
3. Remote LCHWT setpoint (pulse width modulated signal).
4. Remote current limit setpoint (pulse width modulated signal).
5. A "remote mode ready to start" status contact.
6. Safety shutdown status contacts.
7. Cycling shutdown status contacts.
8. Run contacts.

2.8 ELECTRICAL SYSTEM

A. Variable Speed Drive
1. Chiller shall be provided with a variable speed drive (VSD) with circuit breaker, disconnect switch with external lockable handle, and minimum short circuit current rating of 65,000 AIC. The VSD shall be factory mounted on the chiller and shipped completely factory assembled, wired and tested.
2. Drive shall be solid state, microprocessor-based, pulse-width modulation (PWM) type utilizing insulated-gate bipolar transistor (IGBT) output power devices with a power factor of 0.95 or better at all loads and speeds. VSD full load efficiency shall meet or exceed 97% at 100% VSD rated ampacity.
3. Provide VSD with integral 5% impedance line reactor or DC link reactor to reduce the harmonics to the power line and to add protection from AC line transients. VSD voltage total harmonic distortion (THD) and harmonic current total demand distortion (TDD) shall not exceed 35%.
4. The VSD shall be refrigerant cooled, closed loop water cooled, or air cooled. VSD enclosure cooling shall be microprocessor controlled to maintain temperature within acceptable limits for the VSD enclosure.
5. The VSD controls shall automatically regulate compressor speed and inlet guide vanes to optimize chiller efficiency over all chiller operating conditions while avoiding surge. Movable inlet guide vanes and variable compressor speed shall provide chiller unloading.
6. Surge prevention and surge protection algorithms shall take action to prevent surge and move chiller operation away from surge.
7. The VSDs shall each be furnished in a pre-painted, unit mounted, metal enclosure having a minimum short circuit withstand rating of 65,000 amps per UL 508A. It will include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory installed bus bars and all components properly segregated and completely enclosed in a single metal enclosure.
8. Chiller manufacturer shall furnish control wiring diagrams for the installation of chiller and associated equipment.

9. Drive shall be suitable for continuous operation at nameplate voltage ±10%. Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 5 seconds.
10. Drive shall be suitable for operation in ambient temperatures between 32 and 104°F, 95% humidity (non-condensing) for altitudes up to 3300 ft above sea level without derating.
11. Drive shall comply with applicable ANSI, NEMA, UL and NEC standards.
12. A single display shall provide interface for programming and display of VSD and chiller parameters. Viewable parameters include:
    a. Operating, configuration and fault messages
    b. Frequency in Hz
    c. Load and line side voltage and current (at the VSD)
    d. kW (line and load side)
    e. IGBT temperatures
13. VSD shall have a control power transformer that provides power to VSD controls and chiller controls. The refrigerant pump fuse, purge unit fuse, purge unit control power, and control power transformer shall be factory wired.
14. The following 115V discrete contact outputs shall be provided for field wiring:
    a. Chilled water pump
    b. Condenser water pump
    c. Alarm status
    d. Tower fan on
    e. Tower fan off
15. The following protections shall be supplied:
    a. Under-voltage
    b. Over voltage
    c. Over current
    d. Phase loss
    e. Phase reversal
    f. Ground fault
    g. Phase unbalance protection
    h. Single cycle voltage loss protection
    i. Programmable auto re-start after loss of power
    j. Motor overload protection (NEMA Class 10)

2.9 PAINTING

A. All external surfaces shall be protected with one coat of durable, alkyd modified vinyl enamel, machinery paint.

2.10 SHIPPING PROTECTION

A. Chiller manufacturer shall provide protective covering on compressor motor, control center, and unit controls. Water nozzles will be capped with fitted sheet metal closures.

2.11 UNIT INSULATION

A. Each unit shall be factory insulated with anti-sweat flexible closed cell plastic type insulation. Insulation shall prevent sweating in environments with dry bulb temperatures in the range of 50-110 degree F. Minimum thickness shall be 3/4" Armaflex AP or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Provide for connection to electrical service. Refer to Division 26. Include for connection of oil pump to separately fused circuit.

D. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit. Refer to Division 26.

E. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.

F. Install units on vibration isolation. Refer to Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT.

G. Provide evaporator connections to chilled water piping. Refer to Sections 23 21 13 and 23 21 19. On inlet, provide thermometer well for temperature controller, thermometer well and thermometer, strainer, nipple and flow switch, pressure gauge, and shut-off valve. On outlet, provide thermometer well and thermometer, pressure gauge, and balancing valve.

H. Furnish and install necessary auxiliary water piping for oil cooling units and purge condensers.

I. Insulate evaporator and cold surfaces. Refer to Sections 23 07 16 and 23 07 19.

J. Provide condenser connection to condenser water piping. Refer to Sections 23 21 13 and 23 21 19. On inlet, provide thermometer well for temperature limit controller, thermometer well and thermometer, strainer, nipple and flow switch, pressure gage, and shut-off valve. On outlet, provide thermometer well and thermometer, pressure gage, and shut-off balancing valve.

K. Arrange piping for easy dismantling to permit tube cleaning.

L. Provide refrigerant pressure relief vent piping as required. Extend vent piping from each chiller relief device connection to the outdoors without valves or restrictions. Install vent piping per the chiller manufacturer’s installation instructions. Relief vent piping shall be constructed of schedule 40 galvanized steel pipe. Cover the pipe termination with stainless steel bird screen.

3.2 MANUFACTURER'S FIELD SERVICES

A. START-UP: Chiller manufacturer shall furnish start-up service. Refrigerant, oil, evacuation units, and all other miscellaneous materials and tools for start-up shall be furnished by the manufacturer as required. Concurrent owner instruction is to be furnished by the chiller manufacturer. Services shall be documented by a start-up completion record signed off by both the manufacturer and installing contractor.

B. Provide services of factory trained representative for minimum one day to leak test, refrigerant pressure test, start-up, calibrate controls, and instruct Owner on operation and maintenance. Any leaks that are found shall be repaired using methods as recommended by the manufacturer. After repairs have been completed the system shall be evacuated, dehydrated, and fully charged with refrigerant. The chiller shall be re-tested to confirm the system is leak free.

C. Supply initial charge of refrigerant and oil.

D. Manufacturer shall furnish a start-up completion record, signed by the manufacturer's representative and the installing contractor and shall include:
   1. Dates of start-up and personnel in attendance.
   2. Dates of owner instruction and personnel in attendance.
   3. Design performance data.
   4. Actual performance data.

3.3 TRAINING

A. Chiller manufacturer shall, as part of his bid, include the cost of training three owner representatives.

B. This training will be a hands-on and classroom type training which will pertain to the purchased equipment. This training should give the trainees the ability to completely tear down and overhaul the purchased equipment. Any and all literature, manuals or information which is or will be available shall be given to the three trainees.

C. This training will be a two day training session at the owner’s facility.

END OF SECTION

SECTION 23 65 14 - OPEN CIRCUIT COUNTERFLOW COOLING TOWER

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. Section 23 05 26 - VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT

D. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

E. Section 23 05 93 - Testing, Adjusting, And Balancing

F. Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS

G. Section 23 09 63 - Energy Management and Control System (EMCS)

H. Section 23 21 13 - Above Ground Hydronic Piping

I. Section 23 34 00 - HVAC Fans

1.4 REFERENCES

A. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2010.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. CTI ATC-105 - Acceptance Test Code for Water Cooling Towers; 2022.

E. CTI ATC-128 - Test Code for Measurement of Sound from Water-Cooling Towers; 2019.

F. CTI STD-201 OM - Operations Manual for Thermal Performance Certification of Evaporative Heat Rejection Equipment; 2021.

G. CTI STD-201 RS - Performance Rating of Evaporative Heat Rejection Equipment; 2021.

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NEMA MG 1 - Motors and Generators; 2021.

J. OSHA 1910.23 - Occupational Safety and Health Administration standard for guarding floor and wall openings.

1.5 QUALITY ASSURANCE

A. Thermal performance shall be certified by the Cooling Technology Institute (CTI) in accordance with CTI STD-201 RS. In addition, the manufacturer guarantees that the cooling tower shall meet the specified performance conditions when installed according to plans and per the guidelines established in the cooling tower manufacturer's Installation, Operation & Maintenance (IOM) Manual per CTI STD-201 OM.

B. Thermal performance shall meet the minimum efficiency (gpm/hp) requirements per ASHRAE Std 90.1 I-P for induced draft open cooling towers for comfort cooling applications per CTI ATC-105 and CTI STD-201 RS testing procedures.

C. The unit structure shall be designed, analyzed, and constructed in accordance with the latest edition of ICC (IBC).

D. Unit sound performance ratings shall be tested according to CTI ATC-128. Sound ratings shall not exceed specified ratings.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

C. Verify unit voltage matches voltage on electrical drawings.

D. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

E. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

F. Submit manufacturer's installation instructions including: Power, power wiring requirements, control wiring requirements, insulation details for unit motor starter details, etc.

G. Performance Data - Submittal shall include cooling tower manufacturer's computer-generated performance ratings. These computer ratings shall be certified in accordance with CTI STD-201 RS.

H. Sound Data - Submittal shall include sound pressure levels at 30 feet from the tower.

1.7 DELIVERY, STORAGE AND HANDLING

A. The cooling tower shall be stored and handled in accordance with the manufacturer's instructions.

1.8 WARRANTY

A. Manufacturer shall provide a warranty for the entire cooling tower package, including structure, casing, basins, decking, fans, motors and all mechanical drive components against failure due to materials and workmanship for a period of five (5) years from the date of substantial completion. Manufacturer shall also provide a one (1) year warranty for labor for the entire cooling tower package from the date of substantial completion.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Cooling tower shall be a factory-assembled, induced draft, counterflow cooling tower with vertical air discharge.

B. Tower capacity shall be as shown on the drawings to cool water from and to the water temperatures shown with the ambient air wet bulb temperature shown.

2.2 CONSTRUCTION

A. Structural components of the tower, including the framework, mechanical equipment supports, casing panels, fan deck, and fan cylinder shall be fabricated of heavy-gauge type 304 stainless steel and assembled with type 304 stainless steel nut and bolt fasteners. Cold water basins shall be constructed of heavy-gauge type 316 stainless steel.

B. The structure and anchorage shall be designed to withstand a wind load of 60 psf while operating, based on ICC (IBC) and ASCE 7-10.

2.3 MECHANICAL EQUIPMENT

A. Fan(s) shall be propeller type, incorporating heavy-duty, cast aluminum blades. Fan blades shall be individually adjustable and replaceable.

B. Fan(s) shall be driven through a right-angle, industrial-duty, oil-lubricated, geared speed reducer, equipped with an oil level sight glass. All gearbox bearings shall be rated at an L10 service life of 80,000 hours or greater.

C. Fan motor shall be totally enclosed fan cooled (TEFC) and mounted outside the airstream. The motor shall be furnished with special moisture protection on windings, shafts and bearings suitable for mounting outdoors and exposed to weather. Fan motors shall be premium efficient/inverter duty type designed per NEMA MG 1. All wiring and junction boxes shall be weather-tight. All electrical equipment shall be UL-labeled.

D. The mechanical equipment shall be structurally supported independently of the casing and shall be installed and adjusted to proper fan tip clearance at the factory. If mechanical equipment is field installed, a factory-trained technician shall be provided to supervise installation at site.

E. Provide fan guard for protection from accidental contact.

F. Provide extended lubrication line with oil level dipstick adjacent to the motor at the fan deck. Provide oil level switch and integrate with the EMCS to alarm when low oil level is sensed.

2.4 FILL, LOUVERS & DRIFT ELIMINATORS:

A. Fill shall be film-type thermoformed polyvinyl chloride (PVC) conforming to CTI ATC-128 and shall be supported from the tower structure.

B. Fill shall be self-extinguishing, have a flame spread index to meet the requirements of ASTM E84, and shall be resistant to rot, decay and biological attack.

C. Drift eliminators shall be constructed PVC conforming to CTI ATC-128 in easily handled sections. Design shall incorporate three changes in air direction and shall prevent water splash out during fan cycling. Guaranteed drift losses shall not exceed 0.005% of the design water flow rate.

D. Air inlet louvers shall be constructed from ultraviolet (UV) inhibited PVC conforming to CTI ATC-128 and incorporate a framed interlocking design that allows for easy removal of louver screens for access to the entire basin area for maintenance. The louver screens shall have a minimum of two changes in air direction and shall be of a non-planar design to prevent splash-out and block direct sunlight & debris from entering the basin.

2.5 HOT WATER DISTRIBUTION SYSTEM

A. The hot water distribution system shall consist of schedule 40 PVC pipe headers and spray branches with large orifice, non-clog polypropylene or ABS distribution nozzles. The headers shall have a removable cap facilitating quick header cleanout without removal. The spray nozzles shall be held in place by snap-in rubber grommets and the branches should be removable without tools or removal of branch supports, allowing quick removal of individual nozzles or complete branches for cleaning or flushing. Nozzles shall be spaced symmetrically to ensure even distribution of water over the fill. Hot water distribution system shall be designed to accommodate a flow range of 50% to 100% of the design flow rate.

2.6 COLD WATER BASIN AND ACCESSORIES

A. The cold water basin shall be constructed of heavy-gauge type 316 stainless steel panels and structural members. All factory seams shall be welded to ensure watertight construction.

B. The number and type of cold water outlet connections shall be as required to accomplish the outflow piping shown on the plans.

C. Towers of more than one cell shall include piping connections for flow equalization piping between cells. A full-face gasket shall be provided at each equalizer location.

D. Cold water outlet connection shall include a removable anti-vortexing device to prevent air entrainment and large area lift out strainers with perforated openings. The strainer and anti-vortexing device shall be constructed of the same materials as the cold water basin to prevent dissimilar metal corrosion.

E. Each tower cell shall include a factory provided bypass inlet connection to the cold water basin. The bypass inlet connection shall be provided with a diverting hood or diffuser on the basin side to reduce water splashing during water bypass.

F. A factory-installed, float-operated, mechanical make-up valve shall be included. Make up float assembly shall be a mechanical brass valve with an adjustable plastic float.

G. A standpipe overflow shall be provided in each tower cell. Overflows shall be removable to permit flush-out cleaning of the basin. All basin accessories shall be easily accessible through large hinged access doors at each end of each cell of the tower. Provide overflow sensor for integration with EMCS to signal an alarm.

H. The cooling tower cold water basin shall be provided with an electric immersion heater system to prevent freezing in low ambient conditions. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A NEMA 4 enclosure shall house a magnetic contactor to energize heaters; a transformer to provide 24-volt control circuit power; and a solid-state circuit board for temperature and low water cut-off. A control probe shall be located in the basin to monitor water level and temperature.

2.7 AUXILIARY EQUIPMENT

A. Provide each tower cell with a mechanical local reset vibration switch. The mechanical vibration cutout switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower.

B. Provide ladder and handrail for access to top of each tower cell. Provide galvanized steel safety cage for ladder and galvanized steel guardrail system at the top of each tower cell per OSHA requirements. Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the roof or grade level to the base of the tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the tower ladder; and anchoring it at its base.

C. Provide access doors on the motor side of each tower cell to allow maintenance access to the mechanical equipment and hot water distribution system.

D. Provide a galvanized steel access platform at all access doors of the cooling tower. Provide galvanized steel guardrail system for access platform per OSHA requirements.

E. Provide a manual bleed valve in the supply to the tower.

F. Provide each tower cell with a mechanical equipment davit crane. The davit shall be mounted on the fan deck of the tower and shall be capable of lifting, extending, and lowering the heaviest mechanical component of the tower cell over the fan deck and down to grade. At a minimum, the davit system shall include a winch, cable, and load hook.

2.8 ACCEPTABLE MANUFACTURERS

A. Marley

B. Evapco

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items required as per manufacturer’s requirements.

C. Cooling tower must be installed level to ensure maximum thermal performance and to avoid racking.

D. All air inlet faces must have an adequate air supply. If obstructions exist, consult a cooling tower company sales engineer.

E. Erect the proper support grillage to elevate the tower above the pump suction and as shown on the drawings. Mount the tower as directed by the manufacturer and secure to the grillage.

F. Hoisting clips are provided for ease of unloading and positioning. For overhead lifts or where additional safety precaution is prudent, place slings beneath tower.

G. Tower may be supported on vibration isolators at four anchorage points. When multi-cell towers are isolated with vibration isolation springs, the springs must be located under the supporting steel beams and not between support beams and tower.

H. The vertical weight of piping illustrated within tower perimeter may be supported by tower structure. All other piping shall be supported independent of tower.

I. Install all associated factory-furnished tower accessories such as basin heater system, vibration cut-out switches, etc.

J. Make the proper pipe connections for supply and return. Provide drainage and water make-up for the tower. Provide connections for washing the tower down with the supply to the tower valved off. Carry the tower drain to an adequate point of disposal.

K. Place the tower in operation and adjust the bleed rate.

L. Check the fan for proper operation and record motor current draw as required under Balancing and Testing.

END OF SECTION

SECTION 23 73 13 - MODULAR INDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Indoor central station air handling unit.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC
B. Section 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
C. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
D. Section 23 05 26 - VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT
E. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
F. Section 23 07 13 - DUCT INSULATION
G. Section 23 31 13 - Metal Ductwork
H. Section 23 33 00 - DUCTWORK ACCESSORIES
I. Section 23 34 00 - HVAC Fans
J. Section 23 41 00 - Air Filters

1.3 REFERENCES

A. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.
B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
C. AHRI 430 (I-P) - Performance Rating of Central Station Air-handling Unit Supply Fans; 2020.
D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.
F. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024.
G. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).
H. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. NEMA MG 1 - Motors and Generators; 2021.
L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.4 QUALITY ASSURANCE

A. Unit performance shall be certified in accordance with AHRI 430 (I-P) for central station air handling units.

B. Coil performance shall be certified in accordance with AHRI 410.

C. Direct-expansion coils shall be designed and tested in accordance with ASHRAE Std 15 Safety Code for Mechanical Refrigeration.

D. Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

E. Unit shall be rated for sound performance in accordance with AHRI 260 and AMCA 300.

F. Unit shall be provided to comply with the maximum allowable fan horsepower per ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 GENERAL DESCRIPTION

A. Indoor mounted, central station air handling unit designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration, and distribution. Unit shall be assembled for horizontal/vertical application and arranged to discharge conditioned air as shown on the drawings. Units shall be supplied by the specified manufacturer.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

G. Submit manufacturer’s installation instructions under provisions of Division One.

H. Submit operation and maintenance data under provisions of Section 23 02 00.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 WARRANTY

A. The air handling unit manufacturer shall warrant parts and labor for a period of twelve (12) months from date of substantial completion.

1.8 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer’s instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, and fan has been test-run under observation.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

C. Temtrol

2.2 GENERAL DESCRIPTION

A. Unit shall be factory supplied, central station air handler suitable for the capacities and configurations as shown on drawings. Unit may consist of a fan and coil section with a factory installed chilled water or direct-expansion coil, heating coil section, electric heat section, face and bypass section, filter section, access section, mixing box or combination filter-mixing box, return fan, diffuser, or air blender as indicated on the drawings.

B. All sections, whether assembled into a unit or supplied as separate components, shall have mating flanges for bolted assembly. The flange shall extend around the complete perimeter of each section. The manufacturer shall supply bolts and sufficient closed cell gasket for full perimeter coverage.

2.3 CASING

A. All unit sections shall be supplied with a minimum 12 gauge, formed galvanized steel perimeter base rail of at least 6 inches in height designed to support the weight and structural integrity of the unit. Condensate drain connection will not penetrate the base rail. If external isolators are not used, provide 6 inch minimum height housekeeping pads or sufficient overall height to provide p-trap with 1 inch greater that unit total static pressure.

B. Unit panels for all sections shall be double wall construction and shall be constructed of G90 mill galvanized steel, minimum 16 gauge exterior and minimum 20 gauge interior. Casing panels shall be fully removable for easy access to the unit, and shall be secured to structural frame with aluminized or cadmium plated screws. Removal of panels must not affect the structural integrity of the unit. All panels shall have a minimum of 2-inch thick foam insulation (R-13). All panels shall be completely gasketed prior to shipping.

C. Casing air leakage shall not exceed Leakage Class 6 per ASHRAE Std 111 at +/- 8” w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE Std 111 Leakage Class in the submittal. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8” w.g., whichever is less, and shall not exceed 0.0042” per inch of panel span (L/240). Floor panels shall be double-wall construction and designed to support a 300 lb. load during maintenance activities and shall deflect no more than 0.0042” per inch of panel span.

D. Double wall hinged removable access doors with multiple handles shall be provided in the fan, coil, and filter sections on the drive side of the unit. Access doors must also be provided in all sections where the removal of sheet metal screws is required for unit access. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter. Access sections shall be installed where indicated on the drawings and shall be double walled hinged door.

2.4 FANS

A. Units shall be provided with direct-driven, single-width, single-inlet (SWSI) airfoil plenum fans constructed per AMCA requirements for the duty specified. Class I fans are not acceptable. Fan wheels shall be aluminum construction and rated in accordance with and certified by AMCA 210. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan/motor speed. Fans shall be selected such that the operating speed at peak design airflow conditions is not greater than 25% above the associated motor synchronous speed. Fans driven by motors operated by variable frequency drive shall not exceed the maximum fan RPM allowed by the manufacturer under a bypass condition. Each fan/motor assembly shall include a minimum 14 gauge spun steel fan inlet funnel, and a G90 galvanized steel motor support plate and fan base with 2" spring type vibration isolation. Provide horizontal spring type thrust restraints between the unit casing and each fan/motor assembly.

B. Units delivering supply airflow rates of significant magnitude shall be equipped with multiple supply fans in an array configuration. Refer to scheduled values to verify motor quantity per unit. Where multiple fans are provided, backdraft dampers shall be mounted upstream of each fan for isolation and a single source power motor control panel shall be factory installed. All fans shall be factory-wired to motor control panel which shall consist of individual motor overload relays and on-off disconnect switch for power isolation.

2.5 MOTORS

A. All motors shall be premium efficiency, totally enclosed fan-cooled (TEFC), selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG 1 Part 30 and 31, section 4.4.2. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedules.

B. All fan motors shall be operated from variable frequency drives. Variable frequency drives shall be furnished, installed, and wired by the installing Contractor. Reference Section 23 05 26 - VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT for additional VFD requirements. A factory inverter drive balance shall be performed on all air handling units to identify resonant frequencies. A report of the results shall be provided for unit startup purposes.

C. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

2.6 COILS

A. All coils shall be tested at 300 psig air pressure, under water.

B. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

C. Coils shall be aluminum plate fin type with belled collars and shall be bonded to 1/2 inch or 5/8 inch OD copper tubes by mechanical expansion. Coils shall have headers with steel MPT connections. Working pressure shall be 250 psig at 300°F.

D. All coil segments shall be furnished with 304 stainless steel coil casings and 304 stainless steel coil supports.

E. Coils shall be drainable and have non-trapping circuits. Headers shall have drain and vent connections extended to the outside of the unit casing. Supply and return headers shall be clearly labeled on the outside of the unit. Provide grommets at all pipe penetrations through cabinet.

F. Main drain pan shall be double wall, type 304 stainless steel with minimum 2 inch insulation, sloped toward drain fitting, with integral elbow for side discharge and FPT connection, and shall comply with ASHRAE Std 62.1. Drain pans shall be provided for heating and cooling coil sections. A maximum of one drain shall be supplied for each cooling coil section which shall extend at least 18” downstream of the coil. A maximum of one drain shall be supplied for each heating coil section which shall extend beyond the coil. The unit design shall not require a drain pan in any downstream section to contain the coil condensate. Moisture shall not carry over past the coil. Moisture eliminators are not acceptable for moisture carryover prevention.

G. Direct expansion coils shall be furnished with a brass distributor with solder type connections. Suction and discharge connections shall be on the same end regardless of rows deep. Coils shall have intertwined circuits for equal operation on each circuit. Provide the number of distributors equal to the amount of refrigerant circuits to the associated condensing unit. Direct expansion coil shall be selected to match the saturated suction temperature and capacity of the associated condensing unit.

H. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

I. Coils in series shall have a minimum of 14 inch access section between coil casings.

J. In units larger than 10,000 cfm, coils shall be removable through a service panel without disassembly of the unit.

2.7 FILTERS

A. Filter section shall accept 2 inch filters and shall be designed and constructed to house the type of filter specified. Section shall include side access slide rails.

B. A magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the filter.

C. A dirty filter allowance of 0.50” w.g. shall be incorporated into the total static pressure calculation of each air handling unit filter section.

D. Temporary construction filters shall be maintained until substantial completion. At substantial completion permanent filtration media shall be provided as specified.

E. Reference Section 23 41 00 - Air Filters for additional requirements.

2.8 MIXING BOXES AND INLET PLENUMS

A. Mixing boxes and inlet plenums shall be factory installed unless otherwise indicated on the Mechanical Drawings.

B. Field fabricated mixing boxes and sheet metal plenums shall be provided by the installing Contractor where indicated on the Mechanical Drawings. When field fabricated mixing boxes are provided, the installing Contractor and EMCS Contractor shall provide outside air and return air motorized control dampers and actuators.

C. Factory installed mixing boxes, economizer, and/or inlet plenums shall have factory mounted motorized control dampers. Dampers shall be opposed blades and interconnecting outside air, return air, and mixed air (if applicable) type. Installing EMCS Contractor shall furnish damper actuators. All factory installed mixing boxes shall have a double wall hinged access door on the drive side of the unit.

2.9 ACCESSORIES

A. All damper blades shall be galvanized steel, double skin airfoil type, housed in a galvanized steel frame and mechanically fastened to a hex axle rod rotating in stainless steel bearings. Dampers shall be sectionalized to limit blade length to no more than 48 inches so as to minimize blade warpage. Blade seals are required to assure tight closure. The damper shall be rated for a maximum leakage rate of 1 percent of nominal airflow at 1 inch w.g.

2.10 IDENTIFICATION

A. Each air handling unit shall be provided with a durable, deep etched, 0.025" thick, factory installed aluminum identification plate, permanently mounted with the following information.
   1. Unit tag as indicated on the Contract Drawings
   2. Serial Number
   3. Model Number
   4. Airflow Capacity in CFM and Static Pressure
   5. Fan Motor Horsepower
   6. Unit Power Supply: Volts / Ph / Amps
   7. Supply Fan Type
   8. Coil GPM and Pressure Drop
   9. Sales Order Number
   10. Unit Manufacturing Date

PART 3 - EXECUTION

3.1 INSTALLATION

A. All penetrations through the unit cabinet shall be sealed with grommets.

B. At substantial completion all units shall be clean inside and out and left in factory new condition.

C. If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads or approved equal to address high frequency breakout and provide additional unit elevation with overall sufficient height to provide p-trap with one inch greater than the unit total static pressure. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer’s recommendations. Condensate drain connection shall not penetrate the base air handling unit’s rail.

D. Install in accordance with manufacturer’s instructions.

E. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

F. Make electrical connections, taking care that these do not block access to any part of the equipment requiring service.

G. Unit wiring shall comply with NFPA 70 and all applicable UL standards.

H. Connect full size condensate drain pipe to air handling unit and extend to nearest drain.

I. Unit installation shall comply with NFPA 90A requirements.

J. System Startup Requirements: The installing Contractor service technician shall startup all air handling units. Technician shall at a minimum perform the following steps for each unit:
   1. Energize the unit disconnect switch.
   2. Verify correct voltage, phases and cycles.
   3. Energize fan motor and verify correct direction of rotation.
   4. Re-check damper operation: verify that unit cannot and will not operate with all dampers in the closed position.
   5. Energize fan motors and verify that motor FLA is within manufacturer's tolerance of nameplate FLA for each phase.
   6. Program unit VFD to skip or lockout resonant frequencies that were identified by the manufacturer's factory inverter drive balance to prevent the VFD from continuously operating at these frequencies.

K. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fans have been test run under observation.

L. The installing Contractor shall comply with manufacturer's start-up requirements to ensure safe and correct operation.

END OF SECTION

SECTION 23 81 23.16 - COMPUTER ROOM AIR CONDITIONERS, 1.0 TO 8.0 TONS, FLOOR MOUNTED

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Floor mounted computer room air conditioning units with microprocessor based controls.

B. Outdoor remote mounted air cooled condensing units

C. The system shall have a total cooling capacity and a sensible cooling capacity as indicated in the Mechanical Schedules.

D. The unit is to be supplied for operation on a power supply as indicated in the Mechanical Schedules and the Electrical drawings.

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

C. Section 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

D. Section 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

E. Section 23 07 13 - DUCT INSULATION

F. Section 23 07 19 - HVAC Piping Insulation

G. Section 23 34 00 - HVAC Fans

H. Section 23 23 00 - REFRIGERANT PIPING

I. Section 23 41 00 - Air Filters

J. Section 23 31 13 - Metal Ductwork

K. Section 23 33 00 - DUCTWORK ACCESSORIES

L. Section 23 05 93 - Testing, Adjusting, And Balancing

M. Section 23 21 19 - Hydronic Specialties

N. Section 23 21 13 - Above Ground Hydronic Piping

1.4 REFERENCES

A. AHRI 1360 - Performance Rating of Computer and Data Processing Room Air Conditioners; 2016.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

C. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

E. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

L. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

M. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P per rating standards prescribed by AHRI 1360.

B. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, “Hi-Pot” Test (two times rated voltage plus 1000 volts, per NRTL agency requirements), and Metering Calibration Tests. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

C. System shall be supplied with CSA Certification to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for “Heating and Cooling Equipment” and marked with the CSA c-us logo (60Hz only).

D. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

E. UL Compliance: Fans and components shall be UL listed and labeled.

F. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

G. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

H. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

I. Sound Power Level Ratings: Comply with AMCA 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

J. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210 - Laboratory Methods of Testing Fans for Rating.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound power ratings.
   3. Motor ratings and electrical characteristics plus motor and fan accessories.
   4. Materials, gages and finishes, include color charts.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted within or above ceiling. Show the following:
   1. Framing and support members relative to duct penetrations.
   2. Ceiling suspension members.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H. For roof mounted outdoor units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer's designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

D. Deliver units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, refrigeration piping has been tested and charged and fan has been test run under observation.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

1.10 WARRANTY

A. Provide a warranty by the equipment manufacturer for two years from date of shipment from defects in material and workmanship when used in a proper and normal manner. Manufacturer shall have the option to repair or replace the defective part including material and labor.

B. Provide a five year compressor, motor, parts, labor and refrigerant warranty by the equipment manufacturer, effective for five years from date of factory start-up and certification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Liebert/Vertiv

B. Approved Equal

2.2 DX AIR-COOLED REFRIGERATION SYSTEM

A. Single refrigeration circuit shall include a liquid line filter drier, a refrigerant sight glass with moisture indicator, an expansion valve, pressure safety switches, and a liquid line solenoid valve. The indoor evaporator refrigerant piping shall be filled with a nitrogen holding charge and spun shut. Field relief of the Schrader valve shall indicate a leak-free system.

B. The direct-expansion, tilted-slab cooling coil shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. One stainless steel condensate drain pan shall be provided.

C. The system shall be designed for use with R-410A refrigerant, which meets the U.S. Clean Air Act for phase out of HCFC refrigerants.

D. The compressor shall be an R-410A scroll-type with variable capacity operation from 20-100%, commonly known as a digital scroll. The compressor solenoid valve shall unload the digital scroll compressor to provide variable capacity operation. The compressor shall have a suction gas cooled motor, EPDM Rubber vibration isolators, internal thermal overloads, automatic reset high pressure switch with lockout after three failure occurrences, rota-lock service valves, low pressure transducer, and crankcase heater. The compressor shall be removable and serviceable from the front of the unit. The crankcase heater and a discharge check valve shall be provided for additional system protection from refrigerant migration during Off cycles.

E. The compressor sound jacket shall reduce the level of sound emitted from the digital scroll compressor. It shall consist of a 3/8 inch closed cell polymeric 4.5 - 8.5 lb/ft^3 density jacket that encloses the compressor.

F. The compressor shall be an R-410A scroll-type with a suction gas-cooled motor; EPDM vibration isolators, internal thermal overloads, and automatic reset high-pressure switch with lockout after three failure occurrences, rota-lock service valves, low-pressure transducer, and crankcase heater. The crankcase heater and a discharge check valve shall be provided for additional system protection from refrigerant migration during Off cycles. The compressor shall be serviceable and removable from the front of the unit.

G. An electronically-controlled expansion valve (EEV) shall precisely control the flow of liquid refrigerant entering the direct-expansion coil. The EEV shall be of stepper-motor type. The EEV shall maintain consistent superheat of the refrigerant vapor at the outlet of the evaporator coil over the unit's operating range. The valve shall be controlled by a separate electronic controller. Superheat shall be determined through the suction pressure-temperature method.

2.3 AIR COOLED CONDENSER

A. The condenser shall be designed to reject waste heat to outdoor air and to control refrigerant head pressure as indoor equipment loading and outdoor ambient conditions change. The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings. Standard 60Hz units shall be CSA-certified to the harmonized U.S. and Canadian product safety standard “CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment” and shall be marked with the CSA c-us logo.

B. The air-cooled condenser shall be a factory-assembled unit, complete with integral electrical panel, designed for outdoor installation. The condenser shall be a draw-through design.

C. Condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct-driven by individual fan motor(s), electrical controls, housing, and mounting legs. The Liebert air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity. Microchannel coils shall provide superior heat transfer, reduce air-side pressure drop, increase energy efficiency, and significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall reduced sound levels. Various methods shall be available to match indoor unit type, maximum outdoor design ambient and maximum sound requirements.

D. Microchannel coils shall be constructed of aluminum microchannel tubes, fins, and manifolds. Tubes shall be flat and contain multiple, parallel flow microchannels and span between aluminum headers. Full-depth louvered aluminum fins shall fill spaces between the tubes. Tubes, fins, and aluminum headers shall be oven-brazed to form a complete refrigerant-to-air heat exchanger coil. Copper stub pipes shall be electric resistance-welded to aluminum coils and joints protected with polyolefin to seal joints from corrosive environmental elements. Coil assemblies shall be factory leak tested at a minimum of 300 psig. Hot gas and liquid lines shall be copper and shall be brazed using nitrogen gas flow to the stub pipes with spun-closed ends for customer piping connections. Complete coil/piping assembly shall be then filled and sealed with an inert gas holding charge for shipment.

E. Aluminum microchannel coil with E-coat shall provide a flexible epoxy coating to all coil surface areas without material bridging between fins. E-coat shall increase coil corrosion protection and shall reduce heat rejection capacity degradation to less than 10% after a severe 2000 hour 5% neutral salt spray test (ref. ASTM B117). The coating process shall ensure complete coil encapsulation, and the color shall be black.

F. The fan motor/blade assembly shall have an external rotor motor, fan blades and fan/finger guard. Fan blades shall be constructed of cast aluminum or glass-reinforced polymeric material. Fan guards shall be heavy gauge, close-meshed steel wire, coated with a black corrosion resistant finish. Fan terminal blocks shall be in an IP54 enclosure on the top of the fan motor. Fan assemblies shall be factory-balanced, tested before shipment and mounted securely to the condenser structure.

G. The EC fan motors shall be electronically commutated for variable speed operation and shall have ball bearings. The EC fans shall provide internal overload protection through built-in electronics. Each EC fan motor shall have a built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board, allowing each fan to receive and respond to precise fan speed inputs from the Premium Control Board.

H. Electrical controls and service connection terminals shall be provided and factory-wired inside the attached control panel section. Only high-voltage supply wiring and low voltage indoor unit communication/interlock wiring are required at condenser installation.

I. The EC fan/Premium Control System shall include an electronic control board, EC fan motor(s) with internal overload protection, refrigerant and ambient temperature thermistors, and refrigerant pressure transducers. The Premium Control Board shall communicate directly with the indoor unit's controller via field-supplied CANbus communication wires and via field-supplied low voltage interlock wires. The control board shall use sensor and communication inputs to maintain refrigerant pressure by controlling each EC fan on the same refrigerant circuit to the same speed. The Premium control board shall be rated to a temperature of -30°F to 125°F. The premium control shall be factory set for fan speed with low ambient kit control.

J. A Locking-Type disconnect switch shall be factory-mounted and wired to the electrical panel and be capable of disrupting the flow of power to the unit and controlled via an externally mounted locking and lockable door handle. The locking disconnect shall be lockable in support of lockout/tagout safety programs.

K. The electrical panel shall provide at least 65,000A SCCR.

L. The condenser cabinet shall be constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, shall be galvanized steel for strength and corrosion resistance. Panel doors shall be provided on two sides of each coil/fan section to permit coil cleaning. An electrical panel shall be contained inside a factory-mounted NEMA 3R weatherproof electrical enclosure.

M. Aluminum legs shall be provided to mount unit for vertical air discharge with rigging holes for hoisting the unit into position. Standard height is 18 in.

N. Low Ambient Receiver Kit shall contain an insulated, heated receiver tank with sight glasses, mounting plate, mounting hardware, pressure relief valve, rota-lock valve for refrigerant charge isolation and piping assembly with head pressure operated three-way valve and check valve.
   1. Components shall be field-assembled to the condenser. The three-way valve shall sense refrigerant head pressure and adjust the flooding charge in the condenser coil to adjust the condenser heat rejection capacity. The low ambient heater shall be 150W, shall include an integral thermostat to maintain refrigerant temperature at a minimum of 85°F and shall require a separate power supply of 120V-1ph-60Hz.
   2. The Low Ambient Kit shall function with variable speed fan motors and electronic controls that lower fan speed in lower outdoor ambient temperatures for maximum energy efficiency. This system shall allow system startup and positive head pressure control with ambient temperatures as low as 0°F.
   3. Receiver Kit shall contain a painted, un-insulated receiver with integral fusible plug, formed copper pipe for ease of connecting condenser liquid line to receiver and mounting bracket. Additional full-length leg is shipped with condenser (18 in., 36 in. and 48 in.) or with 60 in. leg kit and should be secured to the mounting surface. One receiver kit shall be field installed per refrigerant circuit.

O. A fusible plug kit shall be field-installed on the liquid line for compliance with building codes requiring refrigerant relief during high temperature and building fire conditions.

P. IBC/OSHPD Seismic Certification and ICC (IBC) Wind/Snow Load Compliant condensers shall be provided with any applicable bracing and field-installation instructions. Condensers shall bear a label certifying compliance with IBC/OSHPD requirements.

2.4 FAN SECTION

A. The unit shall be equipped with one plug fan: integral direct driven fan with backward-curved blades and electronically commutated DC motor; commonly referred to as EC fan. The fan speed shall be variable and automatically regulated by the controller through all modes of operation. The fan shall have a dedicated motor, fault monitoring circuitry, and speed controller, which shall provide a level of redundancy. The impeller shall be made of aluminum and dynamically balanced. The EC fan shall be located within the unit. The EC fan shall also provide greater energy savings than forward curved centrifugal fan and variable speed drives.

2.5 AIR FLOW CONFIGURATION

A. Upflow Supply with Front Air Return
   1. The supply air shall exit from the top of the cabinet. The return air shall be through the front factory installed grilles. The EC fan shall be factory mounted in the upper portion of the unit. The fan shall be located to pull air through the filters and cooling coil to ensure even air distribution and maximum coil performance.

B. Upflow Supply with Rear Air Return
   1. The supply air shall exit from the top of the cabinet. The return air shall be through the rear of the factory-supplied, 24" rear return, skirted floor stand assembly with air filters. The EC fan shall be factory mounted in the upper portion of the unit. The fan shall be located to pull air through the filter and cooling coil to ensure even air distribution and maximum coil performance.

C. Downflow Supply with Front Air Discharge
   1. The supply air shall exit from the front of the cabinet opening. The EC fan shall be mounted in the bottom of the unit. The fan shall be located to draw air through the filters and cooling coil to ensure even air distribution and maximum coil performance.

D. Downflow Supply with Front and Right Side Air Discharge
   1. The supply air shall exit from the front and right side cabinet openings. The EC fan shall be mounted in the bottom of the unit. The fan shall be located to draw air through the filters and cooling coil to ensure even air distribution and maximum coil performance.

E. Downflow Supply with Front Air and Left Side Air Discharge
   1. The supply air shall exit from the front and left side cabinet openings. The EC fan shall be mounted in the bottom of the unit. The fan shall be located to draw air through the filters and cooling coil to ensure even air distribution and maximum coil performance.

F. Downflow Supply with Front, Right and Left Side Air Discharge
   1. The supply air shall exit from the front, right and left side cabinet openings. The EC fan shall be mounted in the bottom of the unit. The fan shall be located to draw air through the filters and cooling coil to ensure even air distribution and maximum coil performance.

G. Downflow Supply with Discharge into Raised Floor
   1. The supply air shall exit from the bottom of the unit directly into the raised floor. The EC fan shall be mounted in the bottom of the unit. The fan shall be located to draw air through the filter and cooling coil to ensure even air distribution and maximum coil performance.

2.6 CABINET CONSTRUCTION AND ACCESSIBILITY

A. The exterior panels shall be 20 gauge steel and powder-coated with RAL 7021 black color paint to protect against corrosion. The exterior panels shall be insulated with 1/2” to 1" (12.7 to 25.4 mm), 1-1/2 lb. (0.68 kg) insulation. Front and side panels shall have captive, quarter-turn fasteners. The cabinet shall be designed so that all components are serviceable and removable using the front and right sides of the unit.

B. The exterior panels shall be internally lined with 20 gauge galvanized steel, sandwiching the insulation between the panels for easy cleaning.

C. A locking-type fused disconnect switch shall be mounted in the electrical panel and shall be capable of disrupting the flow of power to the unit. The locking type shall consist of a main unit switch operational from outside the unit. The electric panel compartment shall be accessible only with the switch in the Off position. The locking disconnect shall be lockable in support of lockout/tagout safety programs.

D. The electrical panel shall provide at least 65,000A SCCR. Short-circuit current rating (SCCR) is the maximum short-circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device(s) or for a specified time.

2.7 FILTRATION

A. The filter shall be an integral part of the system and located within the cabinet. The filter shall be deep-pleated, 2 in (51 mm) thick with a MERV 11 rating efficiency based on ASHRAE Std 52.2. A filter clog switch shall be included. Mesh type, cleanable filters shall be unacceptable.

B. Two extra sets of MERV 11 filters shall be provided per system.

2.8 ELECTRIC REHEAT

A. The reheat shall be a low-watt density 304/304 stainless steel finned-tubular electric reheat. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating. The electric reheat shall be controlled in two stages. The reheat elements shall be accessible from the right side of the cabinet. Refer to equipment schedules for heater type.

2.9 INFRARED HUMIDIFIER

A. The humidifier shall be of the infrared type, consisting of high intensity quartz lamps mounted above and out of the water supply. The evaporator pan shall be stainless steel and arranged to be serviceable without disconnecting water supply lines, drain lines, or electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use bypass air to prevent over-humidification of the controlled space. The auto flush system shall automatically flush deposits from the humidifier pan. The system shall be field adjustable to change the cycle time to suit local water conditions. A minimum 1 in. air gap within the humidifier piping assembly shall prevent back flow of the humidifier supply water. Refer to equipment schedules for heater type.

2.10 CONDENSATE PUMP

A. The dual-float condensate pump shall be complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition. The condensate pump shall be factory-installed on upflow units and field-installed on downflow units.

2.11 MICROPROCESSOR CONTROL WITH 9 INCH COLOR TOUCHSCREEN

A. The unit controller shall be microprocessor-based with a 9" color touchscreen display and shall be mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu-driven. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percentage of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards, and diagnostics/service mode.
   1. Password Protection - The unit controller shall contain two unique passwords to protect against unauthorized changes. An auto hide/show feature shall allow the user to see applicable information based on the login used.
   2. Unit Backup and Restore - The user shall be able to create safe copies of important control parameters. The unit controller shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more streamlined unit startup.
   3. Parameter Download - The unit controller shall enable the user to download a report that lists parameter names, factory default settings and user programmed settings in.csv format for remote reference.
   4. Parameter Search - The unit controller shall have search fields for efficient navigation and parameter lookup.
   5. Setup Wizards - The unit controller shall contain step-by-step tutorials or wizards to provide easy setup of the control.
   6. Context-Sensitive Help - The unit controller shall have an on-board help database. The database shall provide context-sensitive help to assist with setup and navigation of the menus.
   7. Display Setup - The user shall be able to configure the display information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back-light timer, and the hide/show of certain readouts shall be configurable through the display.
   8. Additional Readouts - The display shall enable the user to configure custom widgets on the main screen. Widget options will include items such as fan speed, call for cooling, call for free-cooling, maintenance status, call for hot water reheat, call for electric reheat, call for dehumidification, call for humidification, airflow, static pressure, fluid flow rate and cooling capacity.
   9. Status LEDs - The unit controller shall show the unit's operating status using an integral LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
   10. Event Log - The unit controller shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
   11. Service Contact Information - The unit controller shall be able to store the local service or sales contact information.
   12. Upgradeable - unit controller upgrades shall be performed through a USB connection.
   13. Timers/Sleep Mode - The menus shall allow various customer settings for turning the unit On or Off.
   14. Menu Layout - The menus shall be divided into two main menus: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be designed for service personnel and shall provide access to advanced control setup features and diagnostic information.
   15. Sensor Calibration - The menus shall allow unit sensors to be calibrated with external sensors.

16. Maintenance/Wellness Settings - The menus shall allow reporting of potential component problems before they occur.
17. Options Setup - The menus shall provide operation settings for the installed components.
18. Auxiliary Boards - The menus shall allow setup of optional expansion boards.
19. Various Sensors: The menus shall allow setup and display of optional custom sensors. The control shall include four customer accessible analog inputs for field-supplied sensors. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.
20. Diagnostics/Service Mode - The unit controller shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

B. All unit alarms shall be annunciated through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log and communicated to the customers Building Management System/Building Automation System. The unit controller shall activate an audible and visual alarm in event of any of the following conditions:
   1. High Temperature
   2. Low Temperature
   3. High Humidity
   4. Low Humidity
   5. EC Fan Fault
   6. Change Filters
   7. Loss of Air Flow
   8. Loss of Power
   9. Compressor Overload (Optional)
   10. Humidifier Problem
   11. High Head Pressure
   12. Low Suction Pressure
   13. Custom Alarms
   14. Leak Under Floor
   15. Smoke Detected
   16. Standby Unit On
   17. Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm and programmed for a time delay of 0 to 255 seconds.

C. The unit controller shall be factory-set to allow precise monitoring and control of the condition of the air entering and leaving the unit. This control shall include predictive methods to control air flow and cooling capacity based control sensors installed. Proportional and Tunable PID shall also be user selectable options.

D. The unit controller shall be flexible in the sense that it shall allow for controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:
   1. Cooling Capacity
      a. Supply
      b. Remote
      c. Return
   2. Fan Speed
      a. Supply
      b. Remote
      c. Return

d. Manual (for diagnostic or to receive a signal from the BMS through the Liebert remote monitoring devices or analog input)

e. Static Pressure

E. The unit controller shall be able to adjust the capacity output based on supply and return temperature conditions to meet SLA guidelines while operating at highest efficiency.

F. Dew point and relative humidity control methods shall be available (based on user preference) for humidity control within the conditioned space.

2.12 MULTI-UNIT COORDINATION

A. Unit controller shall control multiple units in a parallel, independent and optimized format. The controller shall save energy by preventing multiple units in an area from operating in opposing modes. Teamwork allows the control to optimize a group of connected cooling units using the cooling unit manufacturer's. There shall be three modes of teamwork operation:
   1. Teamwork Mode 1 (Parallel): Is best in small rooms with balanced heat loads. The controlling temperature and humidity sensor readings of all units in operation (fan On) are collected to be used for an average or worst case sensor reading (user selectable). The master unit shall send the operating requirements to all operating units in the group. The control band (temperature, fan and humidity) is divided and shared among the units in the group. Each unit will receive instructions on how to operate from the Master unit based on how far the system deviates from the setpoints. Evaporator fans and cooling capacity are ramped in parallel.
   2. Teamwork Mode 2 (Independent): The unit controller calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the unit's controlling sensors. All sensor readings are shared.
   3. Teamwork Mode 3 (Optimized Aisle): May be employed in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure that the inlet rack temperature is being met. Cooling (Compressors or Economizer) is controlled through unit supply air conditions. unit controller calculates the average or worst-case sensor reading (user-selectable) for heating, cooling humidification and dehumidification. Based on the demand within the group, units will be allowed to operate within that mode until room conditions are satisfied. This is the best form of control for a room with an unbalanced load.

B. The Unit controller shall allow scheduled rotation to keep equal run time on units and provide automated emergency rotation of operating and standby units.

C. The unit controller cascade option shall allow the units to turn On and Off based on heat load when utilizing Teamwork Mode 1, Independent mode or Teamwork Mode 3, Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 1, Cascade mode will stage units On based on the temperature and humidity readings and their deviation from setpoint. In Teamwork 3 Mode, Cascade mode dynamically coordinates the fan speed to save energy and to meet the cooling demands. For instance, with a unit controller group of six units and only 50% of the heat load, the unit controller shall operate only four units at 80% fan speed and leave the other two units in standby. As the heat load increases, the unit controller shall automatically respond to the additional load and bring on another unit, increasing the units in operation to five. As the heat load shifts up or down, the control shall meet the needs by cascading units On or putting them into standby.

D. Each unit controller shall have one factory-supplied and connected supply air sensor that may be used as a controlling sensor or reference. When multiple sensors are applied for control purposes, the user shall be able to control based on a maximum or average temperature reading.

E. The control system architecture of shall allow for a virtual master that coordinates operation. The Virtual Master function shall provide smooth control operation if the group's communication is compromised. When the lead unit, which is in charge of component staging in teamwork, unit staging and standby rotation, becomes disconnected from the network, the Liebert iCOM shall automatically assign a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

2.13 WALL-MOUNT LARGE GRAPHIC DISPLAY PANEL

A. The Large Monochrome Graphic Display Kit shall include an ergonomic, aesthetically pleasing housing, a 320 x 240 dot-matrix graphical display, and a 120 V power supply. The wall-mount large graphic display shall be used to allow remote location of a “System View” display and all features of the Large Graphic User, Service, and Advanced menus for use with manufacturer’s controlled products connected the manufacturer’s communication network.

2.14 MANUFACTURER’S COMMUNICATION NETWORK AND HARDWARE

A. The network switch shall be designed for connecting multiple Ethernet-ready devices. The unit shall have one or two eight-port switches, providing a total of eight or 16 Ethernet ports. The system shall have the capability to accept 100-240VAC single-phase input power for proper operation. A universal power supply (12V, 1.5A) shall be installed inside a steel enclosure secured with a key lock with a hard-wired connection for 120V or 230V operation. A Monochrome display shall be mounted on the front and shall permit interconnected units to communicate through two CAT5 or better network patch cables with RJ-45 connectors to connect devices to available ports.

B. The number of ports available for Ethernet-ready devices varies by the number of eight-port switches included. The Monochrome display provided with the manufacturer’s communication network uses one port for connection to the switch. The 16-port model uses two ports to interconnect the switches.

2.15 ADVANCED MONITORING USING EXISTING NETWORK

A. The Critical Infrastructure Management software shall centrally monitor and manage distributed equipment using the customer's existing network infrastructure. The system shall provide the Critical Infrastructure Management and Monitoring for air conditioning (CRAC) systems, uninterruptible power supply (UPS) systems, power distribution units (PDUs), static transfer switches (STS), direct current power systems (DC), power distribution strips (PDUs), Alber® battery monitoring, rack enclosure intrusion monitoring, leak detection systems and other critical infrastructure systems as specified. The system shall have an architecture that allows up to 10,000 managed devices, including Liebert and third-party devices, in a single-server installation.

B. All material and equipment used shall be standard components, regularly manufactured and available and not custom-designed especially for this project. All systems and components shall have previously been thoroughly tested and proven in actual use before installation on this project.

C. The manufacturer will furnish or supply a site-specific Critical Infrastructure Management software system based on customer requirements. The system must be a software-only solution; no substitutions shall be accepted.

D. The system architecture shall consist of network interface cards that shall be installed in all critical infrastructures that, at a minimum, support HTTP and SNMP simultaneously.

E. The system shall receive SNMP traps from managed equipment and display the alarm notification in a graphical user interface.

F. The system shall be based on SNMP open protocols and shall integrate seamlessly with THE UNIT MANUFACTURER'S software suite and Network Management Systems.

G. Open protocol support shall include:
   1. HTTP(s)
   2. TCP/IP/v4, TCP/IP/v6
   3. SNMPv1, SNMPv2
   4. The system shall have the capability of being remotely monitored and managed 24 hours a day, 7 days a week by the manufacturer.
   5. The system shall have the ability to be deployed worldwide.
   6. The system shall operate as a client-to-server application.
   7. The Web interface of each managed device shall integrate directly into the system.
   8. The system shall support enterprise-level databases including Microsoft® SQL™.
   9. The system shall support exporting of all recorded parametric trend data.
   10. The system shall operate on a server determined by the customer. Specific server brand or function is not permissible.
   11. The system shall support virtual server environments by default.
   12. The system shall include, at no additional cost, one (1) year of Software Assurance.

H. The owner shall furnish the following system components:
   1. Network (LAN) hardware and software required to provide an Ethernet backbone to be used for transport of IP data packets from network interface cards installed in all equipment to the Critical Infrastructure server and to the Liebert Nform workstations. These components may include hubs, routers, cabling, network operating systems, firewalls, IP addresses, virtual private network (VPN) and other components as required. The owner shall supply network drops for the Critical Infrastructure server, workstation clients and all network-interfaced equipment.
   2. Dedicated Critical Infrastructure server meeting the following minimum requirements:
      a. Microsoft® Windows® 7, Windows® 8/8.1 Enterprise, Windows Server® 2003, Windows Server® 2008 (R2) or Windows Server® 2012 (R2) operating system
      b. Pentium™ 3.0GHz single processor or better (1.8GHz dual processor or better recommended)
      c. 4 GB of RAM (memory) or better
      d. 40 GB hard drive (SCSI recommended)
      e. 10/100 BaseT network port or better
      f. Monitor / keyboard and mouse port as required for setup
      g. Standard USB ports
      h. CD or DVD-ROM drive for software installation (CD/DVD-RW suggested for installation and backup)
      i. Critical Infrastructure server may be Virtual Environment compatible
      j. Critical Infrastructure Workstation PCs meeting the following minimum requirements:
      k. System should meet the minimum requirements for Microsoft® Windows® 7, XP, 2003, Windows Vista®, Windows® 8/8.1 Enterprise, Windows Server® 2008 (R2) or Windows Server® 2012 (R2) operating system.
      l. Microsoft Internet Explorer® v9.0 or better

m. 2 GB RAM (or the minimum operating system requirement)

n. 20 GB hard disk (or the minimum operating system requirement)

3. The owner shall supply the following to facilitate system implementation:

a. IP addresses and subnet masks and other information as required to configure network devices

b. A person as the nominated system owner for administrator purposes

c. Secure location for hardware and server

I. Critical Infrastructure System Vendor Responsibilities

1. Provide hardware and software as listed.

a. Critical Infrastructure software and licenses for server and workstation installations.

b. Software Assurance for the first year at no additional cost.

c. 7 x 24 system application and service support through a toll-free telephone number.

d. Warranty (parts and labor) per the manufacturer's warranty statement.

e. Vendor shall be ISO 9001 listed for design and manufacture of environmental control systems for Critical Monitoring and Control applications.

2.16 POINT LEAK DETECTION SENSOR FOR REMOTE MOUNTING

A. A total of 1 (quantity) solid-state water sensor for each individual cooling unit with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The sensor shall provide a single-point detection of leaks. The point detection sensor shall have two gold-plated sensing probes to prevent corrosion resistance and to provide accurate readings. The sensor shall constantly monitor points for leaks, internal faults, and power failures and warn of any abnormal conditions. Mounting brackets shall allow for sensor height adjustment and leveling. The sensor shall provide two independent outputs to signal both a local alarm panel and a remote building management system or external equipment. The sensor shall be rated for 24VAC, 60Hz and 0.10 amps.

2.17 ZONE LEAK DETECTION MODULE WITH CABLE KIT FOR REMOTE MOUNTING

A. A total of 1 (quantity) zone water sensor cables for every 400ft.² of conditioned floor area for raised floor applications only, with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The sensor and control module shall provide a zone detection of leaks. The sensor and control module shall constantly monitor points for leaks, internal faults, and power failures and warn of any abnormal conditions. LED's shall provide status indication and also ensure the cable is properly installed and operational under raised floors. The sensor and control module shall provide two independent outputs provide a signal to a local alarm panel, environmental unit, remote building management system, or external equipment.

B. The control module shall consist of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The control module shall monitor up to 100 feet of connected leak detection cable. The control module shall be rated for 24VAC, 60Hz, and 0.12A.

C. The cable material and construction shall allow the cable to lie flat when used with hold-down clips. The sensor cable shall be plenum-rated and UL-listed for safe operation. Cables shall be available in lengths of 20, 25, 30, 35, and 45 feet.

2.18 HIGH TEMPERATURE SENSOR

A. This sensor shall be factory-installed in the unit and shall be factory-set to 125ºF. It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air. This sensor is not meant to replace any fire detection system that may be required by local or national codes.

2.19 SMOKE SENSOR

A. The smoke sensor samples the return air, shuts down the unit upon activation, and sends visual and audible alarms. Dry contacts are available for a remote customer alarm. The smoke sensor includes a “supervision” contact closure. This smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes.

2.20 REMOTE TEMPERATURE/HUMIDITY SENSOR

A. This sensor shall allow the control of the unit based on temperature/humidity conditions remote to the unit. This sensor shall be field-mounted and wired to the unit control board and the unit shall not have a return-air temperature/humidity sensor mounted inside the unit.

2.21 LOW-VOLTAGE TERMINAL PACKAGE

A. Factory-installed and factory-wired terminals shall be provided for customer connection:
   1. Remote Shutdown Terminals - Two additional pairs of terminals provide the customer with additional locations to remotely shut down the unit by field-installed devices or controls.
   2. Extra Common Alarm Contacts - Two additional pairs of terminals provide the customer with normally open contacts for remote indication of unit alarms.
   3. Main Fan Auxiliary Switch - One set of normally open contacts wired to the EC fan motor contactor will close when EC fan operation is required. This set of dry contacts could also be used to initiate air economizer operation. Air economizer and associated devices by others.
   4. Leak Detector Shutdown - One pair of dry contacts for the sensor signal will provide unit shut down.

2.22 REMOTE HUMIDIFIER CONTACT-OPTIONAL

A. A pair of N/O contacts provided for connection to a remote humidifier that allows the unit's humidity controller to control a humidifier outside the unit. Power to operate the remote humidifier does not come from the unit.

2.23 COMPRESSOR OVERLOAD-OPTIONAL

A. A factory-installed sensor designed to detect high compressor currents and provide signal input to shut down the compressor as a compressor protection feature.

2.24 SUPPLY AIR FLOOR STAND - DOWNFLOW RAISED FLOOR (UPFLOW, NOT REAR RETURN)

A. The floor stand shall be constructed of galvanized steel. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand height shall match the raised floor height.

2.25 RETURN AIR FLOOR STAND ASSEMBLY

A. The upflow unit with rear returns air configuration shall be supplied with a skirted-floor stand assembly. The floor stand assembly shall be constructed of galvanized steel with powder-coated panels and supplied with air filter. The floor stand assembly shall be 24-1/8 in. (613mm) high and have adjustable legs with vibration isolation pads. It shall provide a rear return duct flange and removable panel for filter access.

2.26 DISCHARGE AIR PLENUM

A. The exterior panels shall be 20 gauge steel and powder-coated with black color paint to protect against corrosion. The exterior panels are insulated with 1/2” to 1", 1-1/2 lb. insulation. Front and side panels shall have captive, quarter-turn fasteners.

B. For ducted applications, the unit shall be supplied with a ducted air discharge plenum. The plenum shall be 18in. with top duct connection.

C. For non-ducted applications, the unit shall be supplied with a two-way air discharge plenum. The plenum shall be 18 in. high. Provide two-way, three-way, or four-way discharge grilles per floor plan location of cooling units.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install precision cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

D. Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

E. Install unti and all accessories to comply with NFPA 90A and NFPA 90B.

F. Start the system in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

G. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

H. Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

I. Engage manufacturer's field service technician to provide warranty start-up supervision and assist in programming of unit(s) controls and ancillary panels supplied by them.

END OF SECTION

SECTION 23 82 19 - FAN COIL UNIT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 260 (I-P) - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2017.

C. AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment; 2022.

D. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

E. AHRI 430 (I-P) - Performance Rating of Central Station Air-handling Unit Supply Fans; 2020.

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.

H. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

J. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

N. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

P. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm with at least 5 years of successful installation experience on projects with mechanical installations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84, UL 723 and NFPA 90A.
   1. Exception: Outdoor mechanical insulation may have a flame spread index of 75 and smoke-developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D. Adhesive and other material shall comply with NFPA 90A and NFPA 90B. All adhesives and sealants used on interior of building shall comply with VOC limits prescribed by SCAQMD 1168.

E. Unit fan(s) shall comply with the maximum allowable fan motor horsepower per ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Unit shall meet or exceed minimum efficiency ratings in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P per testing standards prescribed by AHRI 210/240 or AHRI 340/360 (I-P).

G. Units shall be tested and certified with AHRI 430 (I-P) and AHRI 260 (I-P).

H. All coils shall be constructed to meet the requirements of AHRI 410.

1.5 WARRANTY

A. Provide entire unit with parts and labor warranty by the equipment manufacturer for one year from date of s.

B. For units with DX coils, provide all components of the refrigeration circuit with parts and labor warranty by the equipment manufacturer for five years.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

2.2 GENERAL

A. Fan coil units shall be factory built, manufactured as scheduled on Drawings. Contractor shall field verify exact clearances required for fan coil units. Units shall be field located as required and shop drawings shall indicate final location for approval by Architect/Engineer.

B. Furnish and install fan coil units of the type, capacities, ratings and drive motor horsepower shown on the Drawings.

2.3 CASING

A. Unit casing shall be constructed of minimum 18-gauge galvanized steel, able to withstand a 125 hour salt spray test per ASTM B117. Unit shall have access panels on each side constructed of minimum 18-gauge galvanized steel.

B. Unit casing shall be insulated with single wall, 1 inch thick, foil-faced fiberglass insulation with a minimum rating of R-4 and shall be rated for a maximum air velocity of 5,000 feet per minute.

C. All access panels shall be fully insulated and attached with fasteners. No piping or conduit shall pass through any access panel.

D. All units shall be provided with hanger rod holes in top and bottom panels for suspension installations.

2.4 DRAIN PAN

A. All units shall be provided with one-piece stainless steel drain pan with welded corner construction. Drain pan shall be insulated with closed cell foam insulation.

B. For units installed above a ceiling, in a mechanical mezzanine, or in an attic space, provide secondary drain pan. Drain pan shall be galvanized steel and shall slope at a minimum of 1/8” per foot to drain connection. The drain pan shall extend 3” larger on all sides than unit footprint. The secondary drain pan shall be provided with a condensate overflow switch or separate drain line.

2.5 HYDRONIC COILS

A. Coils shall be aluminum plate fin type and shall be bonded to copper tubes by mechanical expansion. The use of soldering or tinning during the fin-to-tube bonding process will not be accepted. Copper tubes shall have a minimum outside diameter of 0.5 inches and shall have a minimum thickness of 0.016 inches.

B. Copper tubes shall comply with ASTM B75/B75M.

C. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

D. All coils shall be hydrostatically tested with air under water at 300 psig minimum pressure and rated for a maximum of 450 psig working pressure at 200°F.

2.6 DIRECT EXPANSION COIL

A. Direct expansion coils shall be furnished with a brass distributor with solder type connections, Suction and discharge connections shall be on the same end regardless of row depth. Coils shall have intertwined circuits for equal operation on each circuit. Provide the number of distributors equal to the number of refrigerant circuits to the associated condensing unit. Refrigerant piping connections shall be clearly labeled on outside of unit.

B. Direct expansion coils shall be selected to match the saturated suction temperature and capacity of the associated condensing unit.

C. Maximum face velocity across cooling coil shall be 500 FPM, unless noted otherwise on equipment schedule.

2.7 ELECTRIC HEATING COIL

A. The unit manufacturer shall furnish an electric resistance heating assembly with heating capacity, voltage and stages as scheduled. The heater assembly shall be factory wired and installed with over temperature protection.

B. The heater assembly shall be designed and rated for installation in a blow through configuration.

C. The heater assembly shall be furnished with an incoming power distribution block capable of accepting at least 125% of the calculated current load.

D. The heater assembly shall be listed for zero clearance meeting all NFPA 70 requirements and shall be cETL listed in compliance with UL 1995.

2.8 FAN AND MOTOR ASSEMBLY

A. Units shall be furnished with double inlet, forward curved centrifugal blower that shall be statically and dynamically balanced as an assembly.

B. Fan and motor assembly shall be in a direct drive, draw-through configuration. Belt drive units are not acceptable.

C. Fan motors shall be electronically commutated with thermal overload protection and constant torque operation. The motor shall be programmed in the factory to meet the specified airflow value.

D. Fan motors shall be permanently lubricated and sealed bearings and shall operate on single or three phase power.

E. Fan motors shall be installed, factory programmed and wired to the control panel. Motor wiring shall be terminated in a junction box external to unit casing.

F. Fan motors shall be internally isolated from unit casing.

2.9 FILTERS

A. All units shall be furnished with a flat filter rack with hinged access on both sides designed for a 2” nominal standard sized filter.

B. Factory shall provide one complete set of spare throwaway filters for each unit.

C. Refer to 23 41 00 - Air Filters for additional information.

2.10 MIXING PLENUM

A. Mixing plenum shall be field fabricated and insulated as shown on drawings.

2.11 CONTROLS

A. The unit fan motor shall be completely factory wired to an external electrical enclosure. An external main incoming power non-fused disconnect switch shall be factory furnished and wired by the unit manufacturer for single point power connection.

B. Each unit shall include a 24 VAC control circuit transformer, motor control board, motor circuit fusing and terminal strip for connection of field wiring.

C. The unit shall be factory run tested and end devices shall be factory wired to terminal strip and tested for wiring continuity.

D. Each unit shall include a low voltage fan speed control device.

2.12 REFRIGERANT LEAK DETECTION

A. Units provided with DX cooling coils shall be provided with factory installed leak detection system with sufficient quantity of refrigerant detection sensors to detect refrigerant leaks throughout the equipment cabinet.

B. When the system detects a leak, the unit controller shall automatically initiate mitigation actions to prevent excessive refrigerant concentrations within occupied spaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer’s requirements.

C. Locations of equipment shown on the drawings are approximate. Locate units so that they may be adequately serviced and maintained.

D. During construction, provide temporary closures of taped polyethylene on openings to prevent construction dust and debris from entering unit.

E. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fans have been test run under observation.

F. Set each unit level and straight.

G. Remove all shipping blocks and restraints.

H. Make condensate drain connection. Verify that drain is properly trapped, vented and sloped to condensate termination location as shown on the drawings.

I. Make duct connections using flexible connectors. Verify that duct is independently and adequately supported.

J. The secondary drain pan shall be provided with a condensate overflow switch or separate drain line.
   1. If a drain line is provided it shall be minimum of 3/4 inch and shall be routed to a visible location approved by the Architect. If this termination point is in a finished ceiling, provide an escutcheon in trim and extend pipe to 1 inch below ceiling and paint to match ceiling color.
   2. If a condensate overflow switch is provided, the overflow switch shall include the following features and adhere to the following installation and operation:
      a. Condensate overflow switch features:
         1) UL 508 listing
         2) 24 volt power connection
         3) Plenum rated casing and wiring when installed in a plenum used for return air

b. The condensate overflow switch shall be installed in the secondary drain pan and shall shut down the entire unit when the primary drain line becomes restricted. The switch shall be adjusted as required to ensure that the switch engages prior to the drain pan overflowing. At a minimum, unit shut down shall:
   1) De-energize supply fan(s)
   2) De-energize heater(s)
   3) De-energize refrigeration circuit(s) for units with DX coils
   4) Close chilled water valves for units with chilled water coils
   5) Close heating hot water valves for units with hot water coils
   6) Close outside air and economizer dampers
   7) Generate an alarm locally at the unit and remotely through the EMCS

3.2 MANUFACTURER START-UP SERVICES

A. Provide authorized representative of the manufacturer to inspect the assembly and installation of each unit. No start-up, testing or adjusting may be performed until the representative has determined that the unit has been properly installed.

B. The representative shall start-up, test and adjust units. The representative shall perform operational checks to make certain that all equipment and controls of the systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tested again.

C. The representative shall prepare and provide a written start-up report to include any measurements taken, test results obtained or corrective actions required.

D. If unit has packaged controls, the manufacturer’s representative shall attend a separate meeting on-site with the EMCS contractor to coordinate and execute programming between the packaged equipment controls and the EMCS.

END OF SECTION

SECTION 26 02 00 - BASIC MATERIALS AND METHODS FOR ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning electrical system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.3 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.4 COOPERATION WITH TRADES

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.5 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic's Engineers (IEEE).

G. American National Standards Institute (ANSI).

H. National Fire Protection Association (NFPA).

I. International Energy Conservation Code (IECC).

1.6 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.

2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.7 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.8 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.9 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
   2. An index page with a listing of all data included in the Submittal.
   3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, table of contents listing all items being submitted at the beginning of each submittal package, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:
1. Switchboards
2. Distribution Panelboards
3. Panelboards
4. Wiring Gutters
5. Heavy Duty Disconnect Switches
6. Lighting Fixtures
7. Lighting Contactors
8. Time Clocks
9. Lighting Control System
10. Photocells
11. Wiring Devices and Plates
12. Conduit and Fittings
13. Wire
14. General Purpose Dry Type Transformers
15. Harmonic Mitigating Type Transformers
16. Emergency Generator
17. Automatic Transfer Switches
18. Sound Reinforcing System
19. Fire Alarm System
20. Surge Protection Devices (SPD)
21. Lightning Protection

I. Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow 1/4” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and ed for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:
   1. Identifying names, name tags designations and locations for all equipment.
   2. Fault Current calculations and Coordination Study.
   3. Reviewed shop drawing submittals with exceptions noted compliance letter.
   4. Fabrication drawings.
   5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
   6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
   8. Equipment name plate data.
   9. Wiring diagrams.
   10. Exploded parts views and parts lists for all equipment and devices.
   11. Color coding charts for all painted equipment and conduit.
   12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
   13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.
   1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
   2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
   3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:
   1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
   2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
   3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 PRODUCT LISTING

A. Products used on this project shall be listed by Underwriters' Laboratories.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.4 EQUIPMENT PADS

A. Provide 4-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

C. Provide a minimum 6-inch-high, steel reinforced concrete pad for generators. Pads shall be sized 6” larger that the outside perimeter dimensions. Provide a 4-foot monolithic extension to the pad around the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.). Refer to structural details. Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise. The generator shall be bolted to the concrete pad per the manufacturers details.

D. Provide steel reinforced concrete pad for utility transformers. Pads shall comply with Utility Company Standards.

2.5 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.6 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.7 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.8 ELECTRICAL SYSTEM IDENTIFICATION

A. Conduit Systems: Junction Boxes and Covers shall be painted per the FBISD Color Code Standards. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:
   1. All major equipment shall have a manufacturer’s label identifying the manufacturer’s address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way. Provide black back plate with white letters and numbers for normal equipment. Provide red back plate with white letters and numbers for optional emergency equipment. Provide yellow back plate with white letters and numbers for Life safety equipment.
   2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, switchboard, distribution panel, motor control center, motor starter panels and panelboards.
      a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
         1) Name
         2) Voltage
         3) Phase
         4) “3” or “4” wire, and
         5) Where it is fed from.
         6) Provide general description such as "Lighting Area F". List Panel Amperage based on supplying feeder size.
      b. An example of a panelboard nameplate is:
         Center Panel – 1HB
         480/277 volt, 3 phase, 4 wire
         Center Fed from DP2
      c. An example of an automatic transfer switch nameplate is:

Center ATS #2
480/277 volt, 3 phase, 4 wire, 4 pole
Center Fed from MSB and DPE

3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.
4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each transformer, safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.
    a. Identifying nameplates shall have 1/4 inch high engraved letters and shall indicate the equipment served.
    b. An example of a disconnect switch is: AHU-1.
5. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.
6. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
7. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

D. Identification of Wiring Devices
1. Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the FBISD Standards require label on the outside of the coverplate for all recessed mounted devices and on the outside face of the coverplate on all surface mounted devices.

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.2 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:
   1. Where shown to be exposed.
   2. Where exposure is necessary to the proper function.

3.3 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. Contractor shall install underground raceways including but not limited to feeders, service laterals, branch circuit and telecommunications. Contractor shall saw cut existing hard surfaces, when required for installation. Contractor shall patch surface to match existing conditions. Contractor shall replace all landscaping material when raceways are installed in these areas. Submit proposed method for patching for review.

C. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

D. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by “3M” or approved equal.

E. Refer to 26 05 33 for additional requirements.

3.4 ELECTRICAL GEAR

A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B. Lighting contactors, time clocks, fire alarm equipment, security equipment disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

C. Fire retardant back boards secured to drywall studs may be used for contactors, time clocks, fire alarm equipment, security equipment, and disconnect switches 60 amp or smaller. All other wall mounted devices shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

3.5 CLEANING

A. Clean lighting fixtures and equipment.

B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.6 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.7 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:
   1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
   2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.
   3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
   4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
   5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F. The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panelboards, panelboards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the one year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION

SECTION 26 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Mechanical, Electrical, Plumbing, and Fire Protection Contractors shall prepare their work and generate 3D models which will be given to the Contractor for coordination. The Contractor will be provided with the REVIT model that was used to generate the contract documents, this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT, but may use any 3-D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

H. Sequence of Coordination
1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated:
    a. Structural and Architectural model
    b. Miscellaneous steel
    c. Perform preliminary space allocation
    d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
    e. Main and medium pressure ducts from the shaft out
    f. Main graded plumbing lines and vents
    g. Sprinkler mains and branches
    h. Cold and hot water mains and branches
    i. Lighting fixtures and plumbing fixtures
    j. Smaller sized ducts and flex ducts
    k. Smaller size cold water and hot water piping, flex ducts, etc.

I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

END OF SECTION

SECTION 26 03 13 - ELECTRICAL DEMOLITION FOR REMODELING
ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

C. The contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

1.2 RELATED SECTIONS

A. Section 01120 - Alteration Project Procedures.

B. Section 02072 - Minor Demolition for Remodeling.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

B. Include in the contract price all rerouting of existing conduits, wiring, outlet boxes, fixtures, etc., and the reconnecting of existing fixtures as necessitated by field conditions to allow the installation of the new systems. Furnish all temporary conduit, wiring, boxes, etc., as required to maintain lighting and power service for the existing areas with a minimum of interruption. Remove wire and conduit back to nearest accessible active junction box and extend to existing homeruns as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Public Address System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner and at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Section 01120, Section 02072, and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets, which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

L. Where existing construction is removed to provide working and extension access to existing utilities, contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

M. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

N. During the construction and remodeling, portions of the project shall remain in service. Construction equipment, materials, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building.

O. Certain work during the demolition phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner`s Representative at least 72 hours in advance.

P. All existing lighting fixtures, switches, outlets, speakers, materials, equipment and appurtenances not included in the remodel or alteration areas are to remain in place and shall remain in service.

Q. Electrical equipment, outlets, speakers, circuits to mechanical and building systems equipment, etc., which are to remain but which are served by conduit and/or circuiting that is disturbed by the remodeling work, shall be reconnected in such as manner as to leave it in proper operating condition.

R. Existing branch circuit wiring which is to be removed, shall be pulled from the raceways and the empty conduit shall be removed to a point of permanent concealment.

S. Within the remodeled or alteration areas where existing walls are being removed, all existing lighting fixtures, switches, receptacles, other materials and equipment and their appurtenances shall be removed, where required by the remodel work either shown or specified.

T. New circuiting indicated to be connected to existing panels shall be connected to "spares" and/or "released" breakers as applicable, or new breakers provided where space is available. Contractor shall verify the existing panel load and feeder capacity prior to adding any additional loads.

U. In all the remodeled areas where existing ceilings are being removed and reinstalled, all existing lighting fixtures, other ceiling mounted devices (i.e. smoked detectors, speakers, etc.) and their appurtenances shall be removed and reinstalled, unless otherwise shown or specified. This also applies to new ceiling installations.

V. Existing lighting fixtures shown to be removed and indicated to be reused, shall be cleaned, repaired, and provided with new accessories as required for the proper operation in their new locations. Provide new lamps and ballast as required.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Section 01120.

3.6 REMOVAL OF MATERIALS

A. The contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor`s responsibility and shall be repaired or replaced by the contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

END OF SECTION

SECTION 26 05 19 - WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.
   1. Wiring for lighting, dimming controls and power.
   2. Automatic Control Wiring.
   3. Connection of equipment shown.
   4. Fire Alarm System.
   5. Voice Communications and Sound System.
   6. Mineral Insulated Cable (MI)

C. WORK SPECIFIED ELSEWHERE:
   1. Heating, ventilating, and air conditioning equipment.
   2. Structured cabling system.
   3. Coaxial cables

1.2 REFERENCE STANDARDS

A. UL 83 - Thermoplastic-Insulated Wires and Cables

B. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire

C. NFPA 70 - National Electrical Code

D. All wire cable and connectors shall be UL approved.

E. NEMA

F. NEMA Bulletin 119

1.3 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE
   1. Southwire
   2. Encore
   3. Cerro

B. 300 VOLT WIRE AND CABLE
   1. Westpenn
   2. Beldon
   3. Alpha
   4. Tappan - Southwire

C. FLEXIBLE CABLE SYSTEMS
   1. AFC Modular Cable Systems
   2. Kaf-Tech

D. CONNECTORS
   1. Ilsco
   2. Cooper
   3. AMP - TYCO
   4. Burndy
   5. Ideal
   6. 3M

7. O.Z. Gedney
8. Thomas & Betts
9. Buchanan

1.4 SUBMITTALS

A. Shop drawings shall include, but not limited to:
   1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C. TYPES:
   1. Provide type “THHN/THWN-2” insulation for all buried feeders and service entrance conductors.
   2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.
   3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
   4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fixture bodies.
   5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.
   6. All dimming conductors shall be 300 volt, 75 C plenum rated. Dimming conductors shall be solid. Stranded conductors are not acceptable.

D. CONDUCTOR SIZES
   1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
   2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
   3. Minimum wire shall be 12 AWG, unless otherwise shown on Drawings or required by Code.
   4. Minimum wire size for 0-10v dimming controls shall be 18 AWG for conductors not exceeding 300 feet circuit length (one-way) and 16 AWG for those exceeding 300 feet (one-way).

E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:
   <u>120/208 Volt</u>

   Neutral: White

   Phase A: Black

   Phase B: Red

Phase C: Blue

Ground: Green

277/480 Volt

Neutral: Gray

Phase A: Brown

Phase B: Purple

Phase C: Yellow

Ground: Green

120/240 Volt

Neutral: White

Phase A: Black

Phase B: Orange

Phase C: Blue

Ground: Green

0-10 Volt dimming conductors

Purple (source)

Pink (common)

a. Low Voltage wiring for Lighting Controls shall be Lime Green.

2.2 GROUNDING

A. Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with NFPA 70.

PART 3 - EXECUTION

3.1 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts. “Wago” push-in connectors are not acceptable.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. “Sta-Cons” shall be used to terminate stranded conductors on all switches and receptacles.

G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

I. Route conductors for 480Y/277 systems in a separate raceway. Do not combine with 208Y/120 volt or 120/240 volt systems.

J. Emergency circuits shall not be routed with normal conductors.

3.2 BALANCING SYSTEM

A. The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.3 LOW VOLTAGE WIRING

A. Low voltage wiring, including dimming conductors, shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.

E. Provide a junction box to make up all joints and splices.

F. Provide dimming conductors for all lighting circuits located in spaces with dimmer switches and theatrical lighting as indicated on the drawings and as specified.

3.4 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

3.5 DEFECTS

A. Defects shall include, but are not to limited to, the following:
   1. Tripping circuit breakers under normal operation.
   2. Improperly connected equipment.
   3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:
   1. Electrical.
   2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.3 STANDARDS

A. National Electrical Code (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.4 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.5 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:
   1. Cut sheets of ground rods, clamps and connectors.
   2. Grounding system diagram.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all materials required to construct a complete grounded electrical system.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each switchboard. Route a separate grounding electrode conductor in conduit from each main gutter to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) under ground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E. GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM
   1. TRANSFORMERS: The center point (neutral) of each wye connected transformer shall be bonded to the case and the grounding electrode conductor shall be connected to the grounded conductor (neutral).
   2. STANDBY EMERGENCY GENERATOR: The generator neutral shall be bonded to the generator when a 4-pole switched neutral automatic transfer switch is specified.

F. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G. CONDUIT GROUNDING BUSHING: Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H. MOTORS: The frame of all motors shall be grounded.

I. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

J. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC and shown on drawings.

K. LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

L. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.2 TESTING

A. Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 Ohms. Provide additional electrodes as required (refer to 250-84 and 250-56 of the most current edition NEC). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 SCOPE

A. Provide electrical raceways and fittings as shown, scheduled and specified.

B. The types of raceways and fittings required are as follows:
   1. Rigid hot-dipped galvanized steel conduit (GRC) (RMC)
   2. Intermediate hot-dipped galvanized steel conduit (IMC)
   3. Electrical metallic tubing (EMT)
   4. PVC (Sch. 40 & 80)
   5. Flexible metal conduit (FMC)
   6. Liquid-tight flexible metal conduit (LFMC)
   7. PVC coated rigid galvanized steel conduit (GRCC)
   8. Rigid Aluminum Conduit (RAC)

1.2 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

F. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

G. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

H. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

I. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

J. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

K. NEMA FB-1

L. NEMA TC3

1.3 ACCEPTABLE MANUFACTURERS

A. Raceways
   1. Allied
   2. Republic
   3. Prime Conduit (Carlon)
   4. Wheatland Tube
   5. Cantex
   6. Western Tube
   7. Robroy Industries

B. Fittings
   1. Appleton

2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.
7. Bridgeport

C. Boxes
1. RACO
2. Thomas and Betts
3. EATON
4. Crouse-Hinds
5. Appleton
6. Hubbell
7. Wiremold
8. FSR

D. Surface
1. Hubbell
2. Wiremold

1.4 SUBMITTALS

A. Product data shall include but not be limited to:
1. Cutsheets for raceways, fitting, solvents, primers, etc.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A. NFPA 70

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Rigid Galvanized Steel Conduit (GRC/RMC)
1. Construction, Materials, Codes, Standards:
a. Article 344 - NFPA 70.
b. Hot-dip galvanized rigid steel conduit, galvanized after fabrication. Products shall comply with UL 6 and ANSI C80.1. All threads shall be galvanized after cutting. A uniform zinc coating shall be applied to the inner and outer walls.
c. Fittings shall be threaded and shipped with thread protectors. Set Screw are not acceptable. Die Cast Fittings are not acceptable.
2. Permitted for use in the following locations:
a. Outdoor or Exterior (Exposed)
b. Indoors, Conditioned Spaces
c. Unconditioned Spaces
d. Underslab (Void Form Slab): where not in contact with earth – only permitted where indicated on plan.
e. Underslab (Suspended Slab): Permitted – only where indicated on plan.
3. Prohibited Locations: Underground, Corrosive environments, Underslab (Slab on Grade), Foundation penetrations.

4. Specific Uses: Exposed Exterior installations, where within or attached to masonry or concrete, where subject to damage.

B. Intermediate Metal Conduit (IMC)
1. Construction, Materials, Codes, Standards:
   a. Article 342 - NFPA 70.
   b. Conduit shall be similar to rigid steel conduit except thinner wall.
   c. Fittings shall be threaded hot-dipped galvanized and shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable
   d. Products shall comply with UL 1242.
2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed)
   b. Indoors, Conditioned Spaces
   c. Unconditioned Spaces
   d. Underslab (Void Form Slab): not in contact with earth only as indicated on plan.
   e. Underslab (Suspended Slab): only where indicated on plan.
3. Prohibited Locations: Corrosive Environment, Underground, Underslab (Slab on Grade), Foundation Penetrations
4. Specific Uses: Exposed exterior locations, Rooftops exposed to sunlight

C. Electrical Metallic Tubing (EMT)
1. Construction, Materials, Codes, Standards:
   a. Article 358 - NFPA 70.
   b. EMT shall be made of hot-dip galvanized strip steel. The interior shall be coated with a corrosion-resistant lubricant for ease of wiring pulling.
   c. Shall utilize steel insulated throat, set-screw connectors and steel set-screw couplings in all indoor conditioned spaces.
   d. Shall utilize steel insulated throat, threadless, watertight compression type connectors and steel threadless watertight compression type coupling in all non-conditioned spaces and in grout filled CMU walls.
   e. Products shall comply with UL 797 and ANSI C80.3.
2. Permitted for use in the following locations:
   a. Indoors, Conditioned Spaces
   b. Unconditioned Spaces
3. Prohibited Locations: Corrosive Environment, Underground, Underslab (all types), Wet or Damp Locations, Exteriors, Within Concrete, foundation penetrations.
4. Specific Uses: Primary use conduit for indoor spaces, where conditioned. Unconditioned locations shall require use of insulated throat water tight fittings.

D. Rigid Nonmetallic Conduit (PVC Schedule 40 & 80)
1. Construction, Materials, Codes, Standards:
   a. Article 352 and 300.6 - NFPA 70.
   b. Conduit shall be schedule 40 or 80 polyvinyl chloride (PVC), UV stabilized, rated for 90°C conductors.
   c. Fittings shall be solvent weld socket type.
   d. Products shall comply with UL 651.
2. Permitted for use in the following locations:
   a. Underground (Earth, outside foundation perimeter)

b. Underslab (Slab on Grade): only where indicated on plan.

c. Under Driveways, roadways, or vehicular crossings, and where required by Utility Company: PVC Schedule 80
   1) PVC Schedule 40 allowed where concrete encased.

3. Prohibited Locations: return air Plenums, interstitial spaces, Outdoor or Exterior (Exposed), Unconditioned spaces, corrosive environments, underslab (suspended or void form), foundation penetrations.
4. Specific Uses: For use underground or underslab (Slab on grade). Underground use is approved for all locations where transiting a project site, not underneath any foundation. For locations under the footprint of building/foundation, use only authorized where indicated on drawings.

E. Flexible Metal Conduit (FMC/Greenfield)
1. Construction, Materials, Codes, Standards:

a. Article 348 - NFPA 70.

b. Spirally wound continuously interlocked zinc coated strip steel.

c. Fittings shall be one screw for smaller than 1-1/2-inch, two screw for 1-1/2-inch and larger, double clamp steel or malleable iron, either cadmium plated or hot-dip galvanized.

d. Products shall comply with UL 360.

2. Permitted for use in the following locations:

a. Indoors, Conditioned Spaces.

3. Prohibited Locations: outdoors/Exterior, unconditioned spaces, Corrosive, Wet, Concrete, underslab(all types), underground, foundation penetrations.
4. Specific Uses and Applications: For use in connection to rotating equipment within conditioned spaces, including plenums. Also permitted for use with empty raceways in walls for use with Low Voltage, AV, telecom cabling.

F. Liquid-Tight Flexible Steel Conduit (LFMC/Seal Tite)
1. Construction, Materials, Codes, Standards

a. Article 350 - NFPA 70.

b. Spirally wound continuously interlocked zinc coated strip steel with a UV stabilized polyvinyl chloride (PVC) outer jacket bonded to the conduit.

c. Fittings shall be compression type, malleable iron, with insulated throat, either cadmium plated or hot-dip galvanized. Plastic is not acceptable.

2. Permitted for use in the following locations:

a. Outdoor or Exterior (Exposed)

b. Indoors, Conditioned Spaces

c. Unconditioned Spaces

3. Prohibited Locations: Concrete, corrosive, underground, underslab (all types), foundation penetrations.
4. Specific Uses and Applications: Primary use is connection to rotating equipment at unconditioned spaces. Transformer Primaries and Secondaries (excluding service transformer).

G. PVC Coated Rigid Galvanized Steel Conduit (GRCC/Plastibond)
1. Construction, Materials, Codes, Standards:

a. Article 344 and 300.6 - NFPA 70.

b. Conduit shall be same as rigid metal conduit with a factory-applied 40-mil-thick covering of polyvinyl chloride (PVC) bonded to the metal, coated inside and outside.

2. Permitted for use in the following locations:
    a. Outdoor or Exterior (Exposed): except for stub-ups and penetrations.
    b. Corrosive Environment: required throughout
        1) Where corrosive environments exist, such as pools, pool pump room, corrosive chemical storage, GRCC shall be provided throughout, up to the point of sealed penetration into a non-corrosive environment.
    c. Underground (Earth, outside foundation perimeter): Required at bends of 15° or greater, Penetrations through concrete, Stub-ups through foundation or grade at concrete.
    d. Foundation Penetrations
3. Prohibited Locations: extended runs exposed to sunlight, Plenums, Underslab except for penetrations (all foundation types).
4. Specific Uses: For use at Cooling Towers, Pools, Pool Decks, Pool pump rooms, chemical storage, corrosive environments.

H. Rigid Aluminum Conduit (RAC)
1. Construction, Materials, Codes, Standards:
    a. Article 344 - NFPA 70.
    b. Rigid aluminum (alloy 6063-T1) conduit shall be manufactured using 6063 Alloy in temper designation T-1.
    c. Fittings for rigid aluminum conduit shall be threaded aluminum shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable
    d. Products shall comply with UL 6A and ANSI C80.5.
2. Permitted for use in the following locations:
    a. Outdoor or Exterior (Exposed)
    b. Indoors, Conditioned Spaces
    c. Unconditioned Spaces
3. Prohibited Locations: Corrosive environments, underground, within concrete, underslab (all types), foundation penetrations.
4. Specific Uses and Applications: Exposed Exterior such as rooftops or canopies.

2.2 PULL BOXES

A. Exterior in-ground pull boxes shall be concrete or polymer as manufactured by Brooks, Dalworth, Hubbell Quazite, or approved equivalent. Covers shall include identification of systems contained.

B. Where located in Roadways, Parking Lots, or Traffic zones, Pullboxes shall be rated to accept a minimum 25,000 lb. load.

C. All Pullboxes shall be sized based on NEC wire-bending requirements at each individual location.

D. Covers shall include identification of systems contained, such as:
1. Electrical
2. Telecom
3. Communications
4. Others, as required.

E. Pull boxes in pole bases shall be as manufactured by Carlon.

F. Pullboxes shall be provided in all raceway systems upon exceeding the following conditions:
1. The equivalent of 270° in conduit bends, or after (3) 90° bends.

2. Any 400ft of linear conduit or duct bank continuous segments.
3. Where required to make transitions to prevent the damaging of conductor insulation.

2.3 WIREWAYS

A. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

B. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrode position paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

2.4 BUSHINGS

A. Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

B. Provide Grounding Bushing as required in 26 05 26 - GROUNDING.

PART 3 - EXECUTION

3.1 PROVIDE CONDUIT AS FOLLOWS:

A. GENERAL: The Drawings are diagrammatic and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B. Raceways shall not be routed below or within slab-on-grade, foundations, or below grade of suspended slab structures, unless specifically noted or indicated otherwise on plan.

C. EMT in sizes up to 4 inches when concealed or not exposed to damage and located indoors only. (EMT is not acceptable in wet and damp location.)

D. MINIMUM SIZE: 3/4 inch.

E. Flexible conduit of any type shall not be used except for connections to rotating or vibrating equipment, or where use for low voltage raceways. All conduit shall be provided as a rigid type conduit for homeruns, runs between termination boxes, outlets, etc.

F. Fixture whips: Refer to 26 51 19 for additional information.

G. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

H. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

I. Have Red seal type VCC or approved equal cable supports in risers, as required by NFPA 70.

J. Have ends reamed after cutting and application of die.

K. Keep conduit corked and dry during construction and swab out before conductors are pulled.

L. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

M. Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

N. Fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet (six feet if using 3/8” manufactured fixture “whips”).

O. Outlet boxes in partitions shall never be set back-to-back. They shall be offset to prevent undue noise transmission from room to room.

P. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

Q. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel with a minimum thickness of 1.07MM and set to extend 4” above slab.

R. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer`s printed instructions.

S. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

T. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

U. All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required per NEC. Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes, junction boxes and conduit.

V. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

W. All new outlets shall be flush mounted. In remodeled areas where wall construction prohibits flush mounting, provide Hubbell 2400 series, unless noted otherwise. Verify exact location and routing with architect before installation.

X. Contractor shall not penetrate waterproof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.2 CONDUIT ROUTING

A. Conduit shall be concealed and by using the shortest practicable route between outlets, including where located on CMU walls.

B. Conduit may be exposed in electrical and mechanical rooms, and central plants, or other industrial type facilities such as warehouses or production plants.

C. Install risers, drops, offsets to avoid ductwork and structural components. Ductwork and structural systems shall take precedence to conduit.

D. Any exposed and visible conduit shall be parallel and perpendicular based on the lines of the building (such as ceiling lines, wall blocking lines, or architectural feature lines) using structural systems to conceal conduit visibility at all opportunities.

E. Concealed conduit shall be run in as direct manner as possible, using long bends. All bend radii shall be 12x conduit diameter. Condulets in lieu of elbows where ease of installation and appearance warrant their use – confirmation with architect is required for this use.

F. Conduit shall be continuous, with no more than (4) quarter bends between terminals, cabinets, boxes, or pullboxes is acceptable. Contractor is expected to provide wireway or boxes at appropriate intervals, in accordance with NFPA 70 for wire bending space. All conduit shall be electrically continuous throughout, including across boxes and cabinets. Terminals of all conduit shall be provided with double lock nuts and bushing, or terminated on conduit hubs. Use of Running Threads prohibited.

3.3 CONDUIT CORROSION PROTECTION

A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B. At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

C. Conduit installed in the air gap between the water-resistant barrier and finish brick shall not exceed 2-ft. in length.

3.4 EXPANSION JOINTS

A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.5 OUTLET AND JUNCTION BOXES

A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B. Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C. Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D. Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F. See notes and details on Drawings for special box requirements.

G. Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H. Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device cover. Secure all outlet boxes with a backing brace connected to two adjacent studs. Mounting brackets with a single ear to rest against the backing sheet rock are not acceptable.

I. Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J. Provide 3-1/2” deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K. Provide shallow 4”x4” boxes in all demountable partitions.

L. Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when " Wall Opening Protective Materials" (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless "Wall Opening Protective Materials" are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

M. Junction, pull boxes, condulets, gutters, disconnects, contactors, etc., above 2-foot x 2-foot grid ceilings shall be mounted within 18-inches of ceiling grid. Above 2-foot x 4-foot grid ceiling they shall be mounted within 30-inches of ceiling grid. All junction box, pull box, gutter openings shall be side or bottom accessible.

N. Junction boxes are prohibited above drywall or plaster ceilings except for lighting; and those must be mounted directly over light fixture opening. Route power, PA, fire alarm conduits to nearest lay-in ceiling.

3.6 THRU-WALL SEALS

A. Provide O.Z. Gedney "Thru-wall" seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B. Straight sleeves are not acceptable.

3.7 PULL BOXES

A. Interior Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code. Size pull boxes per Article 314.28 - NFPA 70.

B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

C. Exterior in-ground pull boxes shall have open bottoms with sand and rock beds below box for drainage of water. Provide closed bottom boxes where specified. Closed bottom boxes shall be provided with sumps for portable pump to allow for extracting water. Refer to details on the drawings.

D. Pull boxes mounted in pole bases shall be coordinated with the pour of the pole base and shall be flush with finished footing.

3.8 WIREWAYS

A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B. Wiring in wireways shall be neatly bundled, tied and suitably tagged.

3.9 UNDERGROUND DUCTBANK SYSTEM

A. DUCT SYSTEM

1. The duct system shall consist of Schedule 40 PVC or type 1-EB PVC conduits encased in red concrete as detailed on the drawings. Use rigid conduit for stub-ups and the last ten feet at the end of each ductbank. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet and shall be free from either horizontal or vertical waves. Duct lines shall be straight unless otherwise noted on the drawings. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 24 inches below finished grade or finished paving at any point. Changes in direction or runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 5 feet. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof using five degree angle couplings. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.
2. Each single conduit of the duct bank shall be completely encased in steel reinforced concrete as indicated. The thickness of concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of trench.
3. Concrete for duct bank envelopes shall be standard 2000 psi concrete mix as described in Division 03, and be colored deep red for permanent marking of underground electrical work. The concrete red pigment shall be pure inorganic natural metallic base pigment, approved by the Engineer before use. Organic pigments will not be permitted. The approved pigments shall be mixed four pounds per yard of cement.
    a. Envelopes may be poured directly against sides of trenches if the "cut" is clean, even and free of loose material. All loose dirt and extraneous material shall be removed from the trenches before and during the pouring of concrete to ensure sound envelopes. Concrete shall be carefully spaded during pouring to eliminate all voids under and between the conduit and honeycombing of the exterior surfaces. Power driven tampers of agitators shall not be used, unless specifically designed for the application, in order to ensure that the water-tightness of the conduits is not destroyed.
    b. Generally, each run of envelopes shall be poured in one continuous operation. Where more than one pour is necessary, each pour shall terminate in a vertical plane. Partial pours shall not terminate in horizontal or angular planes.

B. For normal underground installation see Section 26 02 00, paragraph 3.1 for Excavating and Backfilling.

END OF SECTION

SECTION 26 05 73 - SHORT CIRCUIT COORDINATION STUDY ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish short-circuit and protective device coordination studies for the electrical power system, including all existing and newly installed electrical equipment. The analysis and study shall include all distribution branches, and begin at the main overcurrent protective device.

B. Provide a complete short circuit study, equipment interrupting or withstand evaluation, and protective device coordination study for the power distribution system. Normal operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly addressed in the study. The study shall assume all motors operating at rated voltage and speed. Electrical equipment bus impedance shall be assumed as zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchboard busses and motor control centers (where installed).

C. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all distribution switchboards, motor control centers (where installed, and panel board main circuit breakers. Panel board branch circuit devices need not be considered. The phase over current and ground fault protection shall be included as well as setting for all other adjustable protective devices.

D. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

E. Any problem areas or inadequacies shall be promptly brought to the ENGINEERS attention.

F. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Annex D.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
   4. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
   5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
   6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
   1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code, latest edition
   2. NFPA 70E - Standard for Electrical Safety in the Workplace

1.3 SUBMITTALS FOR REVIEW/APPROVAL

A. The short-circuit and protective device coordination studies shall be submitted to the design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.4 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies, where required, shall be provided on CD in PDF format.

B. The report shall include the following sections:
   1. One-line diagram
   2. Descriptions, purpose, basis and scope of the study
   3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties
   4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
   5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
   6. Incident energy and flash protection boundary calculations
   7. Recommendations for system improvements, where needed
   8. Executive Summary.
   9. Equipment manufacturer’s information used to prepare study
   10. Assumptions made during study.

1.5 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

PART 2 - PRODUCT

2.1 DATA COLLECTION

A. The Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.

D. Include fault contribution of existing motors in the study, with motors <100 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.2 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE 141.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:
1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
2. Incoming switchgear
3. Low voltage switchgear
4. Motor control centers
5. Branch circuit panelboards
6. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Adequacy of transformer windings to withstand short-circuit stresses
4. Cable and busway sizes for ability to withstand short-circuit heating
5. Notify Owner in writing of any new or existing circuit protective devices improperly rated for the calculated available fault current.

2.3 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the curve sheets, where applicable for this project:
1. Electric utility's protective device
2. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands

3. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
4. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
5. Conductor damage curves
6. Ground fault protective devices, as applicable
7. Pertinent motor starting characteristics and motor damage points
8. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.4 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

D. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 75 kVA.

E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

G. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2.

2.5 REPORT SECTIONS

A. Input Data:
1. Short-circuit reactance of rotating machines
2. Cable and conduit materials
3. Transformers
4. Circuit resistance and reactive values.

B. Short-Circuit Data:
1. Source fault impedance and generator contributions
2. X to R ratios
3. Asymmetry factors
4. Motor contributions
5. Short circuit kVA
6. Symmetrical and asymmetrical fault currents.

C. Recommended Protective Device Settings:
   1. Phase and Ground Relays:
      a. Current transformer ratio
      b. Current setting
      c. Time setting
      d. Instantaneous setting
      e. Specialty non-overcurrent device settings
      f. Recommendations on improved relaying systems, if applicable
   2. Circuit Breakers:
      a. Adjustable pickups and time delays (long time, short time, ground)
      b. Adjustable time-current characteristic
      c. Adjustable instantaneous pickup
      d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations
   1. Arcing fault magnitude
   2. Device clearing time
   3. Duration of arc
   4. Arc flash boundary
   5. Working distance
   6. Incident energy
   7. Hazard Risk Category
   8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. The Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

D. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.2 ARC FLASH WARNING LABELS

A. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:
   1. Location designation
   2. Nominal voltage
   3. Flash protection boundary
   4. Hazard risk category

5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

C. Labels shall be machine printed, with no field markings.

D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
1. For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.

E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

SECTION 26 06 34 - LOW VOLTAGE RACEWAY SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 WORK INCLUDED

A. Furnish and install a complete raceway system for telephone system, consisting of cabinets, conduit, junction boxes, etc. This shall include but not limited to fire alarm, access control, structured cabling, audio-video, intercommunications, sound reinforcing, intrusion detection, telephone.

1.3 WORK SPECIFIED ELSEWHERE

A. Section 26 02 00 - BASIC MATERIALS AND METHODS FOR ELECTRICAL
B. Section 26 05 33 - Raceways
C. Section 26 05 19 - WIRE, CABLE AND RELATED MATERIALS

1.4 WORK NOT INCLUDED

A. Cabling
B. Equipment
C. Division 27
D. Division 28

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Conduit - Refer to Section 26 05 33.
B. Backboards - 3/4" X 4' X 8' fire rated plywood painted white.
C. Outlet Boxes - Refer to Section 26 05 33.
D. Pull and junction boxes - Refer to Section 26 05 33.
E. Floor Boxes - Refer to Section 26 05 33.
F. Cabinets - Consult low voltage system installer/supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 26 05 33 for underground service entrance.
B. Provide pull boxes in telephone conduit runs spaced not greater than 100 ft. apart, and on backboard side of runs with more than two right angle bends.
C. Place telephone label on pull and junction boxes.
D. Provide pull wire in each telephone run.

E. Provide plywood backboards and duplex receptacle in the telephone equipment room. Confirm location on jobsite prior to installation.

F. All terminal cabinets/backboards and conduit shall be sized per the recommendations of the telephone system installer.

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

A. Section 019100

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the lighting system and associated controls as well as the service and distribution equipment shall be performed by an impartial technical firm hired by the owner or shall be performed by the installing contractor if the owner has not hired a commissioning firm. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
   2. CBCP - Certified Building Commissioning Professional - AEE
   3. CCP - Certified Commissioning Professional - BCA
   4. CPMP - Certified Process Management Professional - ASHRAE
   5. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as relate to Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide As-built drawings and documentation to facilitate Testing.
   7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   9. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   10. Provide data concerning performance, installation, and start-up of systems.
   11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
14. Provide qualified personnel to assist and participate in Commissioning.
15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
21. Coordinate and provide training of Owner's personnel.
22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority's comments.
23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning Agent proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority.

C. Electrical contractor shall provide a letter certifying the installed lighting controls meet documented performance criteria specified in the commissioning plan within 90 days of substantial completion.

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
    1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
    2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.

3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.
4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.
6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Electrical System Equipment to be tested
1. Occupancy sensors.
2. Time switch controls
3. Daylighting controls.
4. Electrical Service and Distribution System.

C. Testing functions and conditions
1. Daylighting control devices
    a. Verify the devices have been calibrated, properly located and adjusted.
    b. Loads adjust to light level set points in response to daylight.
    c. Location of calibration equipment is accessible to authorized personnel only.
2. Time switches
    a. Verify schedule, time, date and programming is accurate.
    b. Verify override time limit is set, battery is installed and switch operates the lights that are specified in the design documents.
    c. All specified lights can be turned on and off by area control switch.
    d. Manual override switch allows only the lights in the space where the switch is located turn on or remain on until next scheduled shut off.
3. Occupant sensors:
    a. Certify the sensor has been located and aimed in accordance with manufacturer recommendations.
    b. For projects with fewer than seven sensors, each sensor shall be tested.
    c. Fore projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each combination are provided not less than 10 percent shall be tested.
    d. Verify correct operation of status indicators.
    e. Controlled lights turn off or down to the permitted level with in the required time.
    f. For auto-on sensor, the lights turn-on to the permitted level when an occupant enters space.
    g. Verify the lights are not incorrectly turned-on by movement in adjacent areas or by HVAC operation.
4. Electrical Service and Distribution System
    a. Document the ground resistance testing performed by contractors.

b. Document electrical subcontractor has adjusted breakers to setting recommended by coordination study.

c. Document that any required infrared studies are performed.

d. Document testing of transformer insulation and voltage drop.

e. Document any other testing requirements have been fulfilled as required within specifications.

D. Performance criteria
1. Daylighting controls shall maintain specified light levels within 5% of design.
2. All time switches shall be accurate to time on cellular network devices.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist Commissioning Agent with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of seven (7) days prior to date of system startup, submit to Commissioning Agent for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor's responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

C. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. Sampling
   1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
   2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
   3. A common sampling strategy is the "xx% Sampling - yy% Failure Rule", defined by the following example.
      a. xx = the percent of the group of identical equipment to be included in each sample.
      b. yy = the percent of the sample that if failing, will require another sample to be tested.
      c. The example below describes a 20% Sampling - 10% Failure Rule.
      d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
      e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
      f. If 10% of the units in the second sample fail, test all remaining units in the whole group.

g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F. Re-Testing And Failure To Remedy Deficiencies
1. Despite Contractor's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
   a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor's control to resolve expeditiously.
   b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.
   a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G. Deferred Testing
1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

D. Commissioning Agent shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning Agent with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority's copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:
   1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
   2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 26 09 43.13 - DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. Contractor shall provide a complete lighting control system that controls all interior, exterior, and emergency lighting fixtures. This shall include but not be limited to all room controllers, occupancy sensors, low voltage control stations, emergency bypass controllers, low voltage control cable, photocells, digital photo sensors, plug load control, input interface modules and contactors.

B. To Establish equivalent performance, all references in this specification are to products manufacturered by Wattstopper. Other Manufacturers are acceptable as listed below.

1.2 RELATED SECTIONS

A. Section 26 05 33 - Raceways

B. Section 26 51 19 - LIGHTING FIXTURES - LIGHT EMITTING DIODE (LED)

C. Section 25 00 00 - Integrated Automation Building integrator shall provide integration of the lighting control system with Building Automation Systems.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code

B. National Electrical Manufacturers Association (NEMA)

C. FCC emission standards

D. UL 20 - General-Use Switches

E. UL 508 - Industrial Control Equipment

F. UL 916 - Energy Management Equipment

G. UL 924 - Emergency Lighting

H. UL 1008 - Transfer Switch Equipment

I. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

J. CUL - Underwriter Laboratories of Canada

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70 .

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL 916 and/or UL 508.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

C. Catalog sheets and specifications.
   1. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

D. Storage and handling requirements and recommendations.

E. Installation instructions.

F. Shop Drawings: Wiring diagrams a for the various components of the System specified including:

G. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

H. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.

I. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   1. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

J. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

K. Closeout Submittals:

L. Project Record Documents: Record actual installed locations and settings for lighting control devices.

M. Operation and Maintenance Manual:

N. Include approved Shop Drawings and Product Data.

O. Include Sequence of Operation, identifying operation for each room or space.
   a. Include manufacturer's maintenance information.
   b. Operation and Maintenance Data: Include detailed information on device programming and setup.
   c. Include startup and test reports.

1.6 QUALITY ASSURANCE

A. Manufacturer qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
   1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
   2. Review the specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
   4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.
   2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
   3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32° to 104° F (0° to 40° C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

A. Products Warranty: Manufacturer shall provide a 5-year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.11 MAINTENANCE

A. Spare Parts:
   1. Provide 1 spare LMSM-6E. Provide 5 spares of each product listed below to be used for maintenance. Electrical contractor shall deliver items to maintenance department within 30 days of substantial completion.
      a. Room Controllers
      b. Occupancy Sensors
      c. Emergency Bypass controllers
      d. Low voltage switches
      e. Daylighting harvesting photocells
      f. Low Voltage Lighting Control Wiring shall be Lime Green.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acuity Brands
B. Cooper/Eaton/Greengate
C. Lutron
D. Intelligent Lighting Controls

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
   1. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
      a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
      b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
      c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
      d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
   3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
   5. Handheld remotes for personal control: On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.
   6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

7. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
8. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
   1. Features of the DLM local network include:
      a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
      b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
      c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
      d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
   2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
   3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications.

B. Control units include the following features
   1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
   3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
   4. Device Status LEDs to indicate:
      a. Data transmission
      b. Device has power
      c. Status for each load
      d. Configuration status
   5. Quick installation features including:
      a. Standard junction box mounting

b. Quick low voltage connections using standard RJ-45 patch cable

6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100 percent
   b. Turn off
   c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable
   d. Room occupancy status
   e. Total room lighting and plug loads watts
   f. Electrical current
   g. Total watts per controller
   h. Total room watts/sq ft.
   i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:
       1) Establish preset level for each load from 0-100 percent
       2) Set high and low trim for each load
       3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    d. Override button for each load provides the following functions:
       1) Press and release for on/off control
       2) Press and hold for dimming control
    e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

C. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
2. One or two relay configuration
3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
5. WattStopper product numbers: LMRC-101, LMRC-102

D. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
2. Optional real time current and voltage monitoring (with - M Monitoring option).
3. One or two relays configurations
4. Smart 150 mA switching power supply
5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
6. One dimming output per relay
   a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
   a. Sensitivity, 0-100 percent in 10 percent increments
   b. Time delay, 1-30 minutes in 1 minute increments
   c. Test mode, Five second time delay
   d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
3. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
4. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
   a. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

b. Ultrasonic and Passive Infrared
c. Ultrasonic or Passive Infrared
d. Ultrasonic only
e. Passive Infrared only
f. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

5. One or two RJ-45 port(s) for connection to DLM local network.
6. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
7. Device Status LEDs, which may be disabled for selected applications, including:
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
8. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
9. Manual override of controlled loads.
10. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. Units shall not have any dip switches or potentiometers for field settings

C. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

D. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
6. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

D. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
1. Individual button function may be configured to Toggle, On only or Off only.
2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

E. Keyed switches
1. Provide Hubbell SPDT momentary key switches for ON/OFF and dimming control.

2.6 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
9. Configuration LED status light on device that blinks to indicate data transmission.
10. Status LED indicates test mode, override mode and load binding.
11. Recessed switch on device to turn controlled load(s) ON and OFF.
12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
13. One RJ-45 port for connection to DLM local network.
14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.

3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

2.7 DIGITAL PARTITION CONTROLS

A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.

B. Four-button low voltage pushbutton switch for manual control.
1. Two-way infrared (IR) transceiver for use with configuration remote control.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Each button represents one wall; Green button LED indicates status.
5. Two RJ-45 ports for connection to DLM local network.
6. WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.

C. Coordinate contact closure interface for automatic control via input from limit switches on movable walls specified in Section 10 22 43 - Sliding Partitions .
1. Operates on Class 2 power supplied by DLM local network.
2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
3. Input max. sink/source current: 1-5mA
4. Logic input signal voltage High: > 18VDC
5. Logic input signal voltage Low: < 2VDC
6. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
7. Two RJ-45 ports for connection to DLM local network.
8. WattStopper part number: LMIO-102

2.8 HANDHELD CONFIGURATION TOOLS

A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100 (Provide 5 on new construction projects and 3 on renovation projects)

D. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
   1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
   2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
   3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
   4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
   5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
   6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
   7. WattStopper Product Number: LMCT-100

2.9 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:
   1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
   2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
   3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
   4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
   5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
   6. Load control polarity reversal so that on events turn loads off and vice versa.
   7. Per-load DR (demand response) shed level in units of percent.
   8. Load output pulse mode in increments of 1second.

9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
   1. Device list report: All devices in a project listed by type.
   2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
   3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
   4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
   5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
   6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
   7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
   1. Set, copy/paste an entire project site of sensor time delays.
   2. Set, copy/paste an entire project site of sensor sensitivity settings.
   3. Search based on room name and text labels.
   4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
   5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
   1. Mass firmware update of entire rooms.
   2. Mass firmware update of specifically selected rooms or areas.
   3. Mass firmware upgrade of specific products

F. WattStopper Product Number: LMCS-100, LMCI-100

2.10 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
   1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
   2. Push to test button
   3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested (Lime Green) Cat 5e cable with pre-terminated RJ-45 connectors.
   1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
   2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
   3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
   4. Low voltage wiring topology must comply with manufacturer's specifications.
   5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and retest.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
   1. Date of test or inspection.
   2. Loads per space, or Fixture Address identification.
   3. Quantity and Type of each device installed
   4. Reports providing each device's settings.

3.4 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

3.5 RE-COMMISSIONING

A. After 90 days from occupancy the factory authorized representative and electrical contractor shall re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

END OF SECTION

SECTION 26 22 13 - LOW VOLTAGE DISTRIBUTIONS TRANSFORMERS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 480 volt primary step down transformers as shown, scheduled and as specified.

B. The type of transformers required includes dry-type general purpose transformers.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable ANSI/IEEE and NEMA standards.

B. All low voltage transformers shall be UL listed and labeled.

C. All low voltage transformers 15 kVA and larger shall meet or exceed post-January 1, 2016 U.S. DOE efficiency requirements Energy, 10 C.F.R. §431.196(a)(2) (2015) regardless of whether transformer date of manufacture is pre or post January 1, 2016.

D. All low voltage transformers 15 kVA and larger shall be tested for efficiency in accordance with U.S. DOE test methods Energy, 10 C.F.R. §431, Subpart K, Appendix A (2015).

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers for general purpose use:
   1. General Electric Company
   2. Square D Company
   3. Siemens

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of transformers with sound and load ratings, dimensions, weights, impedance rating, insulation type, temperature rise and tap configurations.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. National Electrical Code.

B. Local, municipal, and/or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE

A. Provide dry type, two-winding transformers with primary and secondary voltages and KVA ratings as shown on plans. Transformers shall operate at 60 hertz. All transformers shall be manufacture with standard materials and components.

2.2 MATERIALS AND COMPONENTS FOR GENERAL PURPOSE TRANSFORMERS

A. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall be isolated from the base by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating system requiring the complete removal of all fastening devices will not be accepted. Windings shall be copper or electrical grade aluminum terminated on tin plated or copper bars. Foil windings are not acceptable.

B. The transformer core shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with NEMA, IEEE and ANSI standards.

C. Transformer coils shall be of continuous-wound type construction and shall be impregnated with non-hygroscopic, thermo-setting varnish.

D. Transformers shall be enclosed in drip-proof, metallic enclosures designed to provide for air cooling and prevent accidental contact with live conductors. Wiring compartment shall be located below the core and coil and cooled by air circulation or insulated from the core and coil by means of a suitable thermal insulation barrier. Transformer exposed to weather or installed in a sprinkled area shall have rain shields on all openings. Entire transformer enclosure shall be cleaned, phosphatized, primed and painted with a gray, baked enamel.

E. Transformers shall operate at 100% nameplate KVA rating continuously while in a 40 degree C ambient without exceeding the rated average winding temperature rise of the ANSI insulation system as described below.

Temperature rating shall be as follows:

RATING	PHASE INSULATION-TEMP. RISE
0.025 through 3 KVA	SingleType B - 80º C
5 through 25 KVA	SingleType F - 115º C
3 through 15 KVA	ThreeType F - 115º C
37½ KVA and larger	SingleType H - 150º C
30 KVA and larger	ThreeType H - 150º C

F. Transformers shall have minimum full load rated taps in the primary windings as follows:

RATING	TAPS
3 through 25 KVA	2 - 5% FCBN
15 through 300 KVA	6 - 2-½% TAPS, 2 above and 4 below nominal

G. Maximum sound ratings shall be as follows:

KVA	dBA
0 to 9	40
10 to 50	45
51 to 150	50
151 to 300	55
301 to 500	60

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install transformer in accordance with manufacturer`s written instructions, and recognized industry practices.

B. Housekeeping Pad: Provide a nominal 4" high, 2500 PSI (28 Day) concrete reinforced pad with number 6 welded wire mesh. The pad shall conform to the shape of the transformer and extend at least 3 inches beyond the length and width of the transformer. All corners of the pad shall be rounded.

C. Mounting: Install floor mounted transformers on properly sized rubber-in-shear vibration isolators. Trapeze mounted transformers shall use rubber-in-shear hangers. Wall mounted transformers shall not be mounted directly to the wall without vibration isolation.

D. Connection: Route conductors in a minimum of 2 feet of flexible steel conduit to transformer enclosure. Provide grounding conductor sized per NEC, connected to the building grounding electrode system.

3.2 TESTING

A. Insulation, Tests: Prior to energization, check transformers windings for continuity and test the insulation resistance. Tests shall be made using a Biddle Megger or equivalent test instrument, per manufacturers' recommendations. Provide written documentation of testing. Submit with O & M manuals.

B. Tap Setting: Measure current and voltage under load conditions to provide correct tap settings.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. Provide panelboards as shown, scheduled and as specified herein.

B. The types of panelboards include:
   1. Panelboards.
   2. Power distribution panelboards.
   3. Load centers

1.2 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

B. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

E. UL 67 - Panelboards; Current Edition, Including All Revisions.

F. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

G. UL 943 - Ground fault Circuit Interrupters

H. NEMA PB 1 - Panelboards

I. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

J. NEMA, ABI, Molded Car Circuit Breakers and Molded Case Switches

K. Federal Spec W-P 115, Rev C, Panel, Power Distribution

L. NEMA KSI, Enclosed and Miscellaneous Distribution Equipment Switches (600V)

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company/ABB
   2. Square D Company
   3. Siemens

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. NFPA 70

2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General
1. Provide power distribution and panelboards as indicated in the panelboard schedule and as shown on the plans. . Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B. Busing Assembly and Temperature Rise
1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 65°C. rise above 40°C ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.
2. Bus structure shall be isolated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.
3. The lugs for terminating conductors shall be rated at 75°C on all panel boards and circuit breakers.
4. Provide a non-insulated bare copper ground bus. Provide an isolated ground copper bus in each panel serving isolated ground circuits as indicated on panel schedule or one-line diagram. Provide a full size copper neutral bus in each panelboard enclosure. Provide a 200% neutral buss when served by a harmonic mitigating transformer and any K4 or higher rated transformers.

C. Distribution Panelboards
1. Provide arc energy reduction switch for each overcurrent device rated 1,200 amps or larger to comply with 240.87 of the NEC. Switch shall be equipped with a pad lockable cover with a blue LED pilot light that illuminates when system is activated. Locate switch and cover recessed mounted adjacent to the switch it serves or remote as indicated on the plans. Provide label and all required hardware. Remote switch(es) shall be flush mounted in wall near entry to the room.
2. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between “ON” and “OFF”. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings. Circuit breakers shall be rated 65,000 AIC unless otherwise noted on plans.
3. All fusible switches shall be quick-make, quick-break with visible blades and dual horsepower ratings. Switch handles shall physically indicate “ON” and “OFF” positions. Switches shall be lockable only in the “OFF” position and accept three industrial type heavy duty padlocks. Switch covers and handles shall be interlocked to prevent opening in the “ON” position. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Switches shall include positive pressure rejection type fuse clips for use with UL Class R fuses or Class J fuses and be UL labeled for 200,000 AIC.

D. 480/277 Volt Panelboards

1. Main breakers shall be vertically mounted. Branch mounted main breakers are not acceptable. Provide electronic trip mains with long term, short term and instantaneous trips as indicated on drawings and required for selective coordination.
2. Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breaker shall have an over-center, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have “ON”, “OFF” and “TRIPPED” positions. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 277 volt ac (single pole, 15-30 amperes) or 480Y/277 volts ac (2 and 3 pole) with continuous current ratings as noted on the plan. Interrupting ratings shall be a minimum of 18,000 rms symmetrical amperes at 277 volts ac (single pole) or 480Y/277 volts ac (2 and 3 pole) unless otherwise noted on plans.

E. 240 Volt Panelboards
1. Main breakers shall be vertically mounted. Branch mounted main breakers are not acceptable. Provide electronic trip mains with long term, short term and instantaneous trips as indicated on drawings and required for selective coordination.
2. Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.
3. Circuit breakers shall be UL listed in accordance with UL 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.
4. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.
5. UL Class A 5mA ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker.
6. UL Class B 30mA ground fault circuit protection (GFEP) shall be provided on all equipment circuits requiring ground fault protection. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring.
7. Provide Shunt Trip Breakers including control power for circuits under cooking hoods and other equipment having this requirement.
8. Provide Breakers with Switched Neutral circuits with common trip for gasoline pumps and other equipment having this requirement.
9. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans or served by transformers greater than 150 kVA.
10. Provide 200% sized neutral bus with panels served from a non-linear transformer and any K4 or higher rated transformers. This shall be a UL approved assembly.

F. Cabinets and Fronts

1. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL 50 for cabinets. Wiring gutter space shall be in accordance with UL 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Provide stainless steel front cover for all panels located in all Pool Equipment rooms, Food Labs, Snack Bars, Culinary Arts, Kitchens and Life Skills rooms. All NEMA-1 panels shall have hinged front covers. The front cover shall have a door with hinges, latch and a lock. The piano hinged front covers door-in-door shall allow full access to the circuit breaker gutter area without having to remove the entire front cover. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A welded circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

G. Safety Barrier
1. The distribution panelboard interior assembly shall be dead front with panelboard cover removed. Main lugs or main breakers shall have a barrier. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

H. Integrated Equipment Short Circuit Rating
1. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

I. Metering
1. Provide a branch circuit meter to meter the branch circuits indicated on the drawings. It shall provide kW, kVA, kWh and kVAh. It shall be mounted in the panelboard or externally mounted next to the panel. Communication protocol shall include BACnet and Modbus TCP over ethernet. Connect to the Building Automation System. Program to notify building owner if the load exceeds values set by the energy code indicated on the load analysis. This shall comply with 220.12 Exception No. 1 of the 2020 NEC.
2. Provide a panelboard meter to meter the entire panel as indicated on the drawings. It shall include per phase and total kW, kVA, accumulated kWh, kVAh, power factor, peak demand, frequency, current and voltage It shall be mounted in the panel board or externally mounted next to the panelboard. Communication protocol shall include BACnet and Modbus TCP over ethernet. Connect to the Building Automation System. Program to notify building owner if the load exceeds values set by the energy code indicated on the load analysis. This shall comply with 220.12 Exception No. 1 of the adopted version of the NEC. Connect the meter to the building automation system before entergizing.1
3. Meters shall be provided with an accuracy of 1.0% and shall be certified to ANSI C12.1 or ANSI C12.20 as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NFPA 70 and recognized industry practices.

B. All panels shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

C. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

D. Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

E. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.2 IDENTIFICATION

A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws. Refer to Section 26 02 00, paragraph 2.8(C).

B. Directory Card: Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.

C. Replacement Components: Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturers, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state "caution - Series Rated System." (NEC 110-22). Nameplate shall also identify replacement components.

D. Replacement Components: Nameplate shall identify replacement components.

3.3 INFRARED SCANNING

A. After Substantial Completion by not more than 2 months after Final Acceptance, perform an infrared scan of each panelboard. Remove fronts if not equipped with viewing ports to make joints and connections accessible to a portable scanner. Submit a copy the owner and engineer for review. If O&M manuals are submitted prior to performance of infrared scan, contractor shall submit a signed letter to verify the scan has been arranged. Letter shall indicate the scan provider and the date It will be performed.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. Provide wiring devices as shown, scheduled, required and as specified.

B. The types of wiring devices required include:
   1. Switches
   2. Receptacles
   3. Occupancy Sensors
   4. Digital Timer Switches
   5. Coverplates
   6. Floor Boxes
   7. Fire Rated Poke Through Devices

1.2 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

I. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

J. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. All wiring devices shall comply with NEMA WD 1 and NEMA WD 6 as well as FS W-C-596 and FS W-S-896 as applicable.

B. All switches shall comply with UL 20 as applicable.

C. All receptacles shall comply with UL 498 as applicable.

D. All GFCI receptacles shall comply with UL 943.

E. All USB charging receptacles shall comply with UL 1310.

F. All AFCI receptacles shall comply with UL 1699.

1.4 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Leviton

C. Pass & Seymour

1.5 SUBMITTALS

A. Shop drawings shall include but not be limited to:
   1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.
   2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

1.6 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A. National Electric Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. GENERAL
   1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.
   2. Provide matching one-piece multiple gang plates where switches are ganged.
   3. Provide wall plates for each receptacle furnished.
   4. Architect reserves the right to select wiring device styles and colors to match wall finish.
   5. Wall plates shall be of same manufacturer as devices.

2.2 SWITCHES

A. Provide specification grade Gray toggle switches where indicated on the Drawings. Provide "Red" switches for switching emergency lighting circuits where switching is indicated. Coordinate exact locations with architect.
   1. Wall switches shall be 20 amp, 120-277 volt and shall be Hubbell, Leviton or P&S as follows:

TOGGLE SWITCHES	HUBBELL	LEVITON	P&S
SINGLE POLE	HBL1221	1221-2	PS20AC1
DOUBLE POLE	HBL1222	1222-2	PS20AC2
THREE WAY	HBL1223	1223-2	PS20AC3
FOUR WAY	HBL1224	1224-2	PS20AC4
MOMENTARY CONTACT	HBL1557	1257	1251
THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT	HBL1385	1285	1225
KEY TYPE LOCKABLE BARREL KEY OR CORBIN STYLE	HBL1221-RKL	1221-2KL	PS20AC1-KL
PROVIDE WITH EXTRA KEYS	HBL1209RKL	2KL	4609
DISCONNECT SWITCH / INSTA HOT	HBL7810DS	MS303-DSS	7803

   2. Dimmers: Provide Lutron DIVA or equal as shown on drawings. Wall box dimmers shall be sized to handle the load served. Provide phase dimmers to control LED lamps when 0-10 volt dimming drivers are not provided.
   3. Light Handle Switches: Provide Hubbell HBL1221-IL, Leviton 1221-LHC, P&S PS20AC1-ISl lighted handles to switch emergency lights where noted on the drawings.

2.3 RECEPTACLES

A. Provide specification grade Gray receptacles where indicated on the drawings. Provide “Red” receptacles for receptacles on emergency power. Coordinate exact location with architect. Isolated Ground - Orange, Controlled Receptacle - Green.

B. All grounds on receptacles shall be installed with grounds in the "up" position.

C. All receptacles shall be tamperproof unless located in mechanical, electrical or IDF rooms.
1. Receptacles shall be Hubbell, Leviton or Pass & Seymour as follows:

CONVENTIONAL RECEPTACLES	HUBBELL	LEVITON	P&S
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R DUPLEX	HBL5352	5362	5362
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R SIMPLEX	HBL5361	5361	5361
ISOLATED GROUND 20A, 125V ORANGE NEMA 5-20R DUPLEX	IG5352	5362IG	IG5362
CLOCK HANGER 15A-125V BROWN WITH STAINLESS STEEL PLATE WITH HANGER	HBL5235	5361-CH	S3733-SS
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER RESISTANT FOR LOCATIONS REQUIRING TAMPER RESISTANT INSTALLATION OR AS INDICATED ON THE DRAWINGS	GFRST20	GFTR2	2097TR
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER/WEATHER RESISTANT FOR INSTALLATION IN DAMP/WET LOCATION OR AS INDICATED ON THE DRAWINGS	GFTWRST20	GFWR2	2097TRWR
HEAVY DUTY TAMPER RESISTANT BRASS MOUNTING YOKE	HBL5362WTR	5362-SG	---
TAMPER RESISTANT 20A, 125V DUPLEX	BR20WHITR	8300-SG	TR63-H
SURGE PROTECTION 20A, 125V DUPLEX, BLUE NEMA 5-20R WITH AUDIBLE ALARM	HBL5362SA	7380-B	5362SP
USB CHARGER TYPE DUPLEX 20A, 125V TAMPER RESISTANT, DUAL USB TYPE A PORTS MIN. OF 5A USB OUTPUT, TAMPER RESISTANT	USB20A5x 5A OUTPUT	T5832* 3.6A OUTPUT	2097TRUSBA4* 2.1A OUTPUT
PLUG LOAD CONTROLLED RECEPTACLES 20A, 125V TAMPER RESISTANT WITH TWO CONTROLLED FACES	BR20C2WHITR	TBR20-S2W	TR5362CDW
PLUG LOAD CONTROLLED RECEPTACLES 20A, 125V TAMPER RESISTANT WITH ONE CONTROLLED FACE	BR20C1WHITR	TBR20-S1W	TR5362CHW
ARC FAULT CIRCUIT INTERRUPTER RECEPTACLES	AF20TRW	AFTR2-W	AF202TRW
GROUND FAULT CIRCUIT INTERRUPTER / ARC FAULT DUAL FUNCTION	AFGF20TR	AGTR2-W	AFGF202TR

2.4 OCCUPANCY SENSORS

A. Provide Gray dual technology wall mounted sensors, provide one of the following:
   1. Single Pole:
      a. Wattstopper #DSW301
   2. Double Pole:
      a. Wattstopper # DSW302
   3. Dimmer:
      a. Wattstopper #DW311

B. Provide dual technology ceiling sensor with low voltage controlling switch and power pack.
   1. Single Button:
      a. Wattstopper # DT300 Sensor, BZ150 Power Pack and LVSW101 Digital Switch

C. Provide Ultra Sonic Ceiling sensor for restrooms.
   1. Wattstopper #UT3000, BZ150 Power Pack

2.5 DIGITAL TIMER SWITCHES

A. Provide Wattstopper TS-400-G digital timer. Locate in mechanical, electrical, MDF, and IDF rooms.

B. The time switch shall provide audible notification and visual notification (blink the room lights) prior to turning lights off.

C. The time switch shall have a 12-hour manual override setting.

2.6 COVERPLATES

A. Furnish and install coverplates on all outlet boxes. Oversize (Jumbo) coverplates are not acceptable.

B. Coverplates shall be 302/304 smooth stainless steel

C. Provide Hubbell WP Series, Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

D. Coverplates shall be Hubbell SS Series, Leviton, Pass & Seymour 302/304 smooth stainless steel on all receptacles 30 amps and larger.

E. Stainless steel device plates shall be provided at locations with tile or stone walls.

2.7 FLOOR BOXES

A. Floor boxes with surface activation shall be cast iron as manufactured by Hubbell or equal by Wiremold 880CS/CM series and as indicated below:
   1. Slab at grade (dual level, fully adjustable type 1).
      a. Single gang: #B-2436 w/#SB-3083 carpet flange.
      b. Two gang: #B-4233 w/#SB-3084 carpet flange.
      c. Three gang: #B-4333 w/#SB-3085 carpet flange.
   2. Slab above grade (shallow, fully-adjustable, type II)
      a. Single gang: #B-2421 w/#SB-3083 carpet flange.
      b. Two gang: #B-2422 w/#SB-3084 carpet flange.
      c. Three gang: #B-2423 w/#SB-3085 carpet flange.

3. Cover plates shall have brass finish as follows:
    a. #S-3825 for duplex flap for duplex receptacles.
    b. #S-3826 for data/communications.

B. PVC floor boxes manufactured by Hubbell or equal shall be as follows:
1. Provide CFBS1R4CFB dual service cast iron body floor box with PVC riser. Provide CFBS1R4CUP adjustable mounting cup, S1R4SP2X2DUPLEX sub-plate for (1) Duplex and (2) RJ-45 Keystone jacks OR S1R4SP2X2STYLE for (1) GFCI duplex, USB or Surge Device & (2) Keystone jacks, OR S1R4SPQUAD sub-plate with (4) 20A simplex receptacles, single and dual circuit wiring capability. Provide with CFBS1R4CVR cover, Color to be chosen by Architect.
    a. Maximum finished floor thickness (above top of box collar) with maximum adjustability is 1-1/2-inches at 5-inch, at 6-inches maximum adjustability is 1/2".

C. Floor boxes, recessed activation type, meet UL 514A scrub water requirements, shall be stamped steel with corrosion resistant finish, UL Listed for slab-on-grade installations, or stamped steel for above-grade installations as manufactured by Hubbell or equal by Wiremold RFB2-11 series and as indicated below:
1. Recessed Activation Slab at grade:
    a. Two gang: #CFB2G30CR or CFB2G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15” rise
    b. Four Gang: #CFB4G30CR or CFB4G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.
    c. Six Gang: #CFB6G30CR or CFB6G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall maintain the 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.
    d. Ten Gang AV: #CFB10G55CR or CFB10G55RCR (provisions for round cover), with minimum (2) 2” KO’s, multiple front and back ¾” to 1-1/2” concentric KO’s.. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.
2. Recessed Activation Slab above grade
    a. Two Gang: #CFB2G30 or CFB2G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.
    b. Four Gang: #CFB4G30 or CFB4G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15” rise.
    c. Six Gang: #CFB6G30 or CFB6G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall maintain the 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise

d. Ten Gang AV: #CFB10G55 or CFB10G55R (provisions for round cover), with minimum (2) 2" KO's, multiple front and back ¾" to 1-1/2" concentric KO's.. Flush flange, Surface flange availability. Cover shall not exceed 0.15" rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15" rise.

3. Service Fittings

a. Surface Style Rectangular for use with carpet, tile, VCT and other engineered floors, available with or without carpet insert and offer system's furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

b. Flush Style Rectangular for use with tile, finished concrete or Terrazzo floors, available with or without carpet insert and offer system's furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

c. Rectangular covers shall be powder coated in variety of common finishes, Aluminum, Black, Brass, Bronze and Satin Nickel.

d. Round Covers for use with all floor types Shall provide cable egress doors and systems furniture feed type cover providing (1) ¾-inch and (1) 2-inch threaded openings Round covers shall be plated metal in variety of finishes except Black (powder coated) Brushed Aluminum, Brass Plated, Bronze Plated, Satin Nickel Plated.

2.8 FIRE RATED POKE THROUGH DEVICES

A. Installations requiring 4-inch cored openings, poke thru devices shall be manufactured by Hubbell or approved equal, Hubbell S1R4PTFIT Recessed Activation poke thru with either S1R4SP2X2STYLE or S1R4SP2X2DUPLEX sub-plate for (1) 20A Duplex, GFCI OR USB 2 Port Duplex with (2) openings for (2) RJ-45 Jacks with S1R4CVR - color to be chosen by Architect.

B. Installations requiring 6-inch cored openings, with duplex power, shall be manufactured by Hubbell or Wiremold 6AT, Hubbell S1R6PTWZ-XXX Recessed Activation poke thru which includes S1R6SPW and S1RSSPZ sub plates and S1R6CVR cover, where XXX is finish. Color to be chosen by Architect. This includes (1) pre-wired 20A, 125 V duplex receptacle and (2) NEMA configured rectangular Decorator openings for telephone, signal or up to (12) Category 5e/Cat 6 RJ-45 Jacks.

C. Installations requiring 6-inch cored openings, with quad power, shall be manufactured by Hubbell or Wiremold 6AT, Hubbell S1R6PTDEH-XXX Recessed Activation poke thru which includes S1R6SPH and S1R6SPE sub-plates and S1R6CVR cover where XXX is finish. Color to be chosen by Architect. This includes (2) pre-wired 20A, 125 V duplex receptacles (quad) single, dual circuit capable and (1) NEMA configured rectangular Decorator opening for telephone, signal or up to (6) Category 5e/Cat 6 RJ-45 Jacks plus (2) additional Keystone openings for a total of (8) Category 5e/Cat 6 RJ-45 Jacks for this sub-plate

D. Installations requiring 8-inch cored openings, shall be manufactured by Hubbell or Wiremold 8AT, Hubbell S1R8PTFIT3 Recessed Activation poke thru offering (2) perimeter (outer) sub-plate locations and (3) standard NEMA configured openings in center sub-plate location allowing multiple combinations for power, data and A/V connectivity devices including acceptance for third party AV devices such as Crestron, FSR, Extron.

E. Poke thru devices with above floor service fittings shall be Hubbell PT7XC Series or Wiremold RC9 approved equal for 3-inch cored openings with FR280BKA Pedestal Service Fitting for (1) 20A, 125V duplex receptacle and (1) NEMA configured Decorator opening for telephone, signal or Cat 5e/Cat 6 data cables with RJ-45 jacks.

F. Poke Thru devices for furniture feed applications shall be Hubbell S1R6PTFF-XXX or Wiremold 6AFTT where XXX is finish, to be chosen by Architect. Provides (1) ¾" threaded entry for Power feed and (1) 2-0" threaded opening for Data/AV Cables. Installed in 6-inch cored openings.

G. Poke Thru devices for furniture feed applications shall be Hubbell S1PTFF-XX or Wiremold 4FF or approved equal where XX is finish, to be chosen by Architect. Provides (1) ¾" threaded entry for Power feed and (1) 1-1/2" threaded opening for Data/AV Cables. Installed in 4-inch cored openings.

PART 3 - EXECUTION

3.1 WIRING DEVICE MOUNTING HEIGHTS

A. Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:
   1. Switches 42" above finished floor.
   2. Wall mounted receptacles shall be installed vertically at 15 inches to the bottom outlet above finished floor unless otherwise noted or as required by local codes.
   3. Wall telephone outlets shall be mounted 15 inches to the bottom above finished floor unless otherwise noted. Mount even with wall mounted receptacles.
   4. At locations above counters, set devices at 6 inches above to the centerline counter tops, verify exact mounting height with the architect.

3.2 INSTALLATION (REFER TO 26 05 33 FOR OUTLET BOX SPECIFICATIONS)

A. Wall switches shall be set in a suitable steel box and shall be installed on the strike side of the door as finally hung, whether so indicated on the Drawings or not.

B. Receptacles shall be installed in a suitable steel box.

C. The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.

D. Provide multi-gang device covers at locations where devices gang together.

E. Device locations are indicated schematically on the drawings along with the type and mounting height. Final locations and mounting heights shall be coordinated with the Architect on the jobsite, and with shop drawings of equipment; including equipment to be furnished and installed by the Owner. Devices installed in walls covered with vinyl, fabric wallpaper or other special finishes shall be coordinated and verified with the Architect on the job site.

F. Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

G. Provide keyed switches in all common areas not monitored by the faculty (i.e. gym, corridors, cafeteria, commons natatoriums).

H. All 15 amp and 20 amp receptacles shall be tamper-resistant type.

I. All 20A, 120V receptacles in food service areas shall be GFCI.

J. Provide GFCI circuit breakers for all drinking fountain branch circuits where GFCI receptacles are not indicated on plan.

K. Provide ARC Fault circuit interrupters (AFCI) as required to comply with article 210.12 of NFPA 70. This shall include but not be limited to dwelling units and dormitories. AFCI breakers may be used.

L. Provide ground fault circuit interrupter (GFCI)/ARC Fault circuit interrupter (AFCI) dual function receptacles to comply with articles 210.8, 210.12 and 406.4 of NFPA 70.

M. Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the inside face of the coverplate for all recessed mounted devices and on the outside of the coverplate on all surface mounted devices.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SCOPE

A. Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.

B. The type of fuses include:
   1. 600 volt current limiting.
   2. 250 volt current limiting.

1.2 STANDARDS

A. ANSI

B. UL

1.3 ACCEPTABLE MANUFACTURERS

A. Eaton Bussmann

B. Mersen

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of all fuses showing ratings and fuse curves.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 CURRENT - LIMITING FUSES

A. General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.

B. Mains, Feeders and Branch Circuits
   1. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time Delay Fuses KRP-C. Fuses shall employ "O" ring as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be peened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .1 seconds or less and be listed by Underwriters` Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L.

C. Class J Fuses

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes rRMS symmetrical. The fuses shall be UL Class J.
2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK LPJ. The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPJ installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class LPJ or L. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPJ as shown on the drawings. The fuses shall be UL Class J.

D. Class RK1 Fuses
1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK1.
2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.
3. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

2.2 SPARES

A. Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.
1. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
2. BUSSMANN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.

B. All fuses shall be installed in fuse holders.

END OF SECTION

SECTION 26 28 16 - SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.
   1. NEMA KS1 - Enclosed switches
   2. Federal specification W-S-865C-Heavy duty switches

B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company/ABB
   2. Square D Company
   3. Siemens

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.2 MATERIALS AND COMPONENTS

A. Switch Interior
   1. All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

1. Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral
   1. Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D. Ratings
   1. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures
   1. Indoor switches shall be furnished in NEMA 1 enclosures.
   2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.
   3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.
   4. Switches installed in kitchens shall be stainless steel.
   5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F. Electrical Interlock Contacts
   1. Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G. Service Entrance
   1. Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.1 GENERAL

A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer’s written instructions, NEC and recognized industry practices.

B. Location: Install switches within sight of controllers.

C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.2 IDENTIFICATION

A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION

SECTION 26 29 01 - MOTORS AND STARTERS

PART 1 - GENERAL

1.1 SCOPE

A. Provide manual motor starters as shown, scheduled and as specified herein.

B. All integral motor starters furnished under Division 23 requirements shall be installed under Division 26 requirements unless noted otherwise on the plans.

C. Refer to 26 29 13 for motor starter specifications.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company/ABB
   2. Square D Company
   3. Siemens

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of all enclosures, switches, overloads, ratings, and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL: Refer to the Drawings for starter requirements for each motor.

2.2 MANUAL MOTOR STARTERS

A. GENERAL: Manual starters shall consist of a manually operated toggle switch equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Contacts shall be double break, silver alloy, visible from both sides of starter. Manual starters shall be square "D" class 2510 or 2512 or approved equal. Provide the size and number of poles shall be as shown and required by equipment served. Furnish red pilot light as indicated.

B. ENCLOSURES: All manual motor starter enclosures shall be NEMA 1, general purpose enclosures, unless shown otherwise. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTORS

A. GENERAL: Mount electric motors which are not factory installed.

B. MOTOR CONNECTIONS: Provide electrical and grounding connections to motors as indicated. Connections as follows:
   1. Not less than 18 inch length of Sealtite, extending from motor connection box to motor branch circuit conduit on outdoor and wet locations. Provide Greenfield for inside dry locations.
   2. Install connections mechanically secure, assuring electrical continuity, proper and effective grounding.

C. INSTALLATION OF MOTOR STARTER
   1. Install motor starters in accordance with the manufacturer`s written instructions, the applicable requirements of the NEC and the NECA`s "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.
   2. Combination starter disconnects and starters mounted in ceiling plenums shall be installed 18” above ceiling grid.

END OF SECTION

SECTION 26 29 26 - MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B. The types of miscellaneous control devices and wiring include but not limited to the following.
   1. Contactors
   2. Relays
   3. Photocells
   4. Time switches
   5. Relay Panels
   6. Additional control wiring and safety devices as shown and specified.
   7. Connect power from fire alarm relays to starters to shut down air handling units.

C. WORK SPECIFIED ELSEWHERE:
   1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 22 and Division 23.
   2. All control wiring and conduit shall be furnished under Division 23. All power wiring 120 volt or larger shall be provided by Division 26.
   3. Refer to building controls specification, Division 23 for scope of work required to be performed by Division 26 (electrical contractor).
   4. Specification 26 05 19 - WIRE, CABLE AND RELATED MATERIALS.

1.3 REFERENCE STANDARDS

A. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

D. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

E. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. NFPA 70
   2. Local municipal or state codes that have jurisdiction.
   3. UL 916
   4. UL 924

1.5 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. LIGHTING CONTACTORS AND RELAYS
    a. General Electric Company/ABB
    b. Square D Company
    c. Automatic Switch Company
    d. Eaton
    e. Siemens
2. PHOTOCELLS AND TIME SWITCHES
    a. Tork, Inc.
    b. Intermatic time controls
3. RELAY PANELS
    a. Wattstopper
        1) LMCP
    b. Cooper/Eaton
        1) ControlKeeper

PART 2 - PRODUCTS

2.1 MATERIAL

A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:
1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA ICS 2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
    a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
    b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.
11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.

12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.
13. Provide hand-off-automatic controls (H-O-A) for each lighting contactor.
14. Provide relays and contactors to shut down air handling units.

C. Photocells for Stand-alone controls (not part of relay panel controls): Provide a specification grade self-contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:
1. Switch "ON" at dusk and "OFF" at dawn.
2. Adjustable from 2 to 50 foot-candles.
3. Rated at 2,000 watts.
4. Use 1" diameter cadmium sulphide cell.
5. Have a 2-minute delay to prevent false switching.

D. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E. Control wiring shall be not less than #14 AWG type THWN/THHN and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

F. Relay Panels
1. Rated 277V, 60Hz.
2. Panel operating voltage of 120-277V
3. Uses any of the following relays:
    a. Mechanically Latching Relays
    b. Multi-pole Relays
4. 15A, 20A, and 30A rated relays available
5. Basic Capabilities:
    a. 7-Day Clock
    b. Capable of being set for 7 different day types per week
    c. Includes automatic holiday shutoff feature
    d. Has program backup to restore operations after power failure
    e. Can be expanded to include override switches
    f. On-board programming and processing
6. Each individual relay can be individually or group programmable to operate based on user-provided parameters, manual switch operation, photocells and sensors, or automatic program routines.
7. Rated for minimum of 10 million operations.
8. Contains occupant warning features to flash relays prior to time-out to notify occupants of change of state.
9. Capable of interfacing with other systems via RS-232, RS-485, or Ethernet.
10. Capable of interfacing with occupancy sensors for zone control.
11. Capable of Switch-Masking or Lockout features for user-operated switches.
12. Provide Locking Hinged Enclosures as suitable for relay panel environment. At a minimum, all relay panels shall be NEMA 1, and may be included with the relay panel assembly from the manufacturer. Provide enclosures to house relay panels where NEMA 1 is insufficient, as follows:
    a. Outdoors and unconditioned spaces: NEMA 3R
    b. Central Plants, or any plant with process water systems: NEMA 4/12
    c. Outdoors, Within 50-miles of saltwater coastlines: NEMA 4X
13. Dimming Modules shall be furnished with each relay panel, where dimming is required, per plan.

14. Pushbutton switches manufactured as compatible with the relay panel to either be used as override switches, or general control switches.
15. Provide photocells for use by relay panels for exterior ambient light monitoring:
    a. 1 per relay panel, when relay panels are stand alone
    b. 1 per building, when relay panels are networked

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install miscellaneous electrical controls and wiring to provide a functioning system.

B. Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

C. Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources.

D. Provide miscellaneous connections for signs and other furnished equipment as shown on the Drawings.

E. Provide NEMA 3R/4/4X/12 enclosures where located outside.

F. Provide low-voltage cabling between relay panels and all control devices. Cabling shall be furnished by contractor as required by panel manufacturer, including Cat5, Cat6, Belden, dimming pairs, or other as required by the manufacturer. Pre-terminated cabling by manufacturer is acceptable.

G. All Low-Voltage cabling, for all systems, shall be neatly routed using J-Hooks. Cabling is installed above a hard ceiling, conduit shall be used to traverse the hard-ceiling segments.

H. Install photocells high on North Facing walls, or in accordance with manufacturer installation.

3.2 DIVISION 22, 23, 27 AND 28 MISCELLANEOUS POWER AND CONTROLS

A. Install electrical devices not an integral part of system equipment providing conduit, boxes, fittings, wiring, circuit breakers, disconnecting means and other devices.

B. Contractor is responsible for providing all line voltage power to devices that require electrical power to operate. Contractor shall terminate line voltage power to termination points. Contractor shall coordinate between all trades to determine sizing and quantities of line voltage circuits to adequately power and control devices. Provide circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available or indicated.

C. Provide GFCI receptacle with weather proof cover within 25 feet of all heating, air conditioning and refrigeration equipment.

3.3 OPERATIONS PERSONNEL TRAINING

A. All relay panels require manufacturer technician time to meet with owner, set programming conditions, time of day operations, and ensure owner-intended operations are met, based on whichever is most appropriate based on project size:
    1. 8-Hours per relay panel
    2. The amount of time required to successfully meet the criteria of this section and result in a fully working system, accepted by the Owner.

B. A one-time recommissioning site visit, 4 Hours in time, by a manufacturer technician anytime between 90 and 120 days of building occupancy to adjust and reprogram (as required) the system based on owner input. This meeting shall be scheduled by the manufacturer and can only be declined by the owner.

C. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.

END OF SECTION

SECTION 26 51 19 - LIGHTING FIXTURES - LIGHT EMITTING DIODE (LED)

PART 1 - GENERAL

1.1 SCOPE

A. Provide general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:
   1. LED

1.2 STANDARDS

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings. “ETL listed” is an acceptable listing.

B. NFPA 101

C. ANSI C82.1

D. NEMA-LE

E. All LED drivers shall be UL recognized Class 2 per UL1310 or non-Class 2 per UL 1012 as applicable.

F. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, for Non-Consumer Equipment.

G. All LED drivers shall be RoHS compliant.

H. TM-21

I. LM-80

J. LM-79

K. L70

L. DLC

M. UL 1008

1.3 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. LED DRIVER:
   1. Provide one of the following manufacturers
      a. Eldo
      b. Lutron
      c. Osram
      d. Philips

C. LAMPS:
   1. Provide one of the following LED Chip manufacturers
      a. Cree
      b. Nichia
      c. North American Philips

d. Seoul
e. Lumileds

1.4 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.
B. Provide driver and LED module data brochures for each fixture type.
C. Provide air handling and heat removal data for light fixtures specified with these requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:
1. Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, LED modules, lamp holders, drivers, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.
B. Lighting Fixture Types:
1. LED Fixtures
a. Fixtures shall be pre-wired with frame-in kit and integral thermal management system for fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.
b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.
c. Interior LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50µs, 2 ohm combination wave).
d. Exterior LED fixtures shall have integral common mode and differential mode surge protection of 10kV/10kA(1.2/50µs, 2 ohm combination wave).
2. Exit signs
a. Exit signs shall meet all federal, state and local codes.
b. Provide fire alarm interface relay when required to flash exit signs.
c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.2 LED MODULES AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.
2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.
3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).
4. Provide driver with integral color-coded leads.
5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.
6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.
7. Provide drivers with a Class A sound rating.
8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).
9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.
11. Driver performance requirements shall be met when operated to 50% of full load rating.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Drivers shall comply with NEMA 410 for in-rush current limits.
14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED Lamps shall be appropriately matched to the driver with junction-down design for improved thermal management. Maximum DC Forward Current.

2.4 EMERGENCY LED BATTERY BACKUP

A. Provide Bodine #BSL310M for emergency light fixtures in 9 or 10-foot ceiling.

B. Provide Bodine #BSL20 for emergency LED driver for emergency light fixtures in ceiling heights greater than 12 feet.

C. Provide Bodine #BSL17-C2 for emergency LED driver for LED downlights.

D. Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in NEC article 700.12 (F).

2.5 POLES

A. Provide poles for area lighting fixtures as specified. Poles shall be one piece, anchor base, with 2-piece steel bolt cover and vibration dampers. Poles shall be round straight steel as specified on the Lighting Fixture Schedule.

B. Provide all poles with appropriate mounting accessories including arms, tenons, or bullhorns as required. Anchor bolts shall be hot dipped galvanized, sized as required by the manufacturer of the pole.

C. All poles shall have a normal 3” x 5” hand hole at 18” above the base flange and grounding provision.

D. Poles shall be prime painted interior and exterior. The exterior shall be finished with polyester powder coating and architectural finish as specified by the Architect. The interior with 3 mil thermoplastic hydrocarbon resin, or equivalent to meet 1000-hour salt spray exposure (ASTM B-117).

2.6 BRANCH CIRCUIT EMERGENCY TRANSFER SWITCH (BCELTS)

A. Provide 20 amp, 120-277 Volt, UL1008 listed Branch Circuit Emergency Transfer Switch to control emergency light fixtures transferring from normal to emergency branch circuits Provide Bodine GTD 20A or ETC SC 1008 UL 924 Devices are not acceptable

2.7 AUTOMATIC LOAD CONTROL RELAY (ALCR)

A. Provide 3 amp, 120-277 volt UL 924 listed. Relay to bypass switching controlling emergency branch circuit light fixtures Provide Bodine GTD or Wattstopper ELCU.

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. General
1. Install the type of lighting fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in lighting fixtures as required by building code.
3. Adjust all adjustable lighting fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for lighting fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination
1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.
2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all lighting fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting
1. Provide support channels to support outlet boxes used support surface mounted lighting fixtures such as exit signs or downlights.
2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.

3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.
4. Provide secondary support wires from all four (4) corners of the lay-in fixtures to the structure above. Do not support fixtures from ceiling grid wire supports, piping, conduit, side walls, or mechanical equipment. Ceiling specifications do not supersede this requirement.
5. Where pole mounted luminaries are provided, provide appropriate anchor base pole as specified with manufacturer's recommended anchor bolts. Verify exact location on site for poles with Architect, Civil, and Landscape documents. Poles shall be installed on proper footing. Refer to details on the drawings. Provide grounding connection to a separately driven ground rod, outside of the footing. Where indicated provide pole with identification plate indicating pole number.

D. Electrical Connection
1. All light fixtures shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 6'- 0". Provide #12 AWG conductors. All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E. Fire Rated Ceiling
1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer. Provide proper rated drivers for lighting fixtures installed within these rated enclosures.

F. Air Handling Fixtures
1. Install all air handling light fixtures with return air slot in the open position, if it is to be as an air handling fixture. Coordinate with mechanical contractor.

3.2 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. Replace all other defective fixtures showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls. Refer to other sections and details on the drawings for lighting controls.

END OF SECTION

SECTION 2 1 - GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Division and the associated Drawings, Addenda (when issued), and Contract Documents, identifies the requirements, technical design, and specifications for Communications Systems at Fort Bend ISD George Bush High School, located in Richmond, Texas.

B. Functionally complete Communications Systems shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether or not specifically called for, at no additional cost to Owner.

C. The Communications Systems include the following:

1. Structured Cabling System
2. And the associated pathways for the systems listed above.

1.2 RELATED SECTIONS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27 and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents and shall coordinate them with the work on the project.

B. Refer to Division 26 for Electrical System requirements.

C. Refer to Division 28 for Electronic Security requirements.

1.3 CONFIDENTIALITY

A. Limit access to physical and electronic versions of these Division 27 specifications and associated Drawings to individuals directly involved in performing the Work.

B. At the conclusion of the Project, cross-shred any physical (paper) copies of both drawings and specifications before disposal.

1.4 ABBREVIATIONS

A. ADA – Americans with Disabilities Act

B. AFF – above finished floor

C. AHJ – authority having jurisdiction

D. ANSI – American National Standards Institute

E. AV – audiovisual

F. BOM – bill of materials

G. CAT – category

H. CATV – cable television

I. CD – Construction Document

J. DAS – distributed antenna system

K. EMI – electromagnetic interference

L. EMT – electrical metallic tubing
M. ERRC – emergency responder radio coverage
N. FACP – fire alarm control panel
O. FCC – Federal Communications Commission
P. F/UTP – foiled, unshielded twisted pair
Q. GC – general contractor; Contractor
R. GMP – guaranteed maximum price
S. GUI – graphical user interface
T. HVAC – heating, ventilation, and air-conditioning
U. IBC – International Building Code
V. ICT – information and communications technology
W. IDF – intermediate distribution frame; a secondary Communications Room in a building
X. IMC – intermediate metal conduit
Y. ISO – International Organization for Standardization
. ISP – inside plant
AA. ISP – Internet service provider
BB. IT – information technology
CC. LAN – local area network
DD. MDF – main distribution room; the primary/main Communications Room for a building
EE. MPOE – minimum point of entry
FF. MTBF – mean time between failures
GG. NEC – National Electric Code
HH. NEMA – National Electrical Manufacturers Association
II. NFPA – National Fire Protection Association
JJ. NRTL – nationally recognized testing laboratory
KK. OEM – original equipment manufacturer
LL. OSP – outside plant
MM. PoE – power over Ethernet
NN. POS – point of sale
OO. POTS – plain old telephone service
PP. RF – radio frequency
QQ. RFI – request for interpretation/information
RR. RMC – rigid metal conduit
SS. RU – rack unit
TT. ScTP – screened twisted pair
UU. STP – shielded twisted pair
VV. TIA – Telecommunications Industry Association

WW. TR – telecommunications room

XX. U/FTP – unshielded twisted-pair cable with foil screened twisted-pair conductors

YY. UL – Underwriters Laboratory

. UPS – uninterruptible power supply

AAA. USB – universal serial bus

BBB. UTP – unshielded twisted pair

CCC. VLAN – virtual LAN

DDD. VPN – virtual private network

EEE. WAN – wide area network

FFF. WAP – wireless access point

GGG. WLAN – wireless LAN

1.5 DEFINITIONS

A. Wherever used in the Division 27 specifications or associated drawings and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. If any of these terms are defined in the General Conditions in Division 1, those definitions shall take precedence.

1. Addenda – written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
2. Bid – the offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
3. Bidder – the individual or entity who submits a Bid directly to Owner.
4. Bidding Documents – the Bidding Requirements and the proposed Contract Documents (including all Addenda).
5. Bidding Requirements – The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
6. Change Order – A document recommended by Design Consultant which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
7. Communication(s) Room – A generic term for a dedicated room for information technology equipment, frequently referred to as Telecommunications Room, Telecom Room, IDF, MDF, IT Room, or Equipment Room.
8. Contract – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
9. Contract Documents – Those items so designated in the agreement between Owner and Contractor covering the Work.
    a. The Contract Documents are complementary; what is required by one is as binding as if required by all.
10. Contractor – The individual or entity with whom Owner has entered into the Agreement.
11. Design Consultant – the design firm responsible for creation of these Division 27 specifications and associated Drawings – COMBS Consulting Group LP.

a. Except for the following Work, where a third-party is responsible:

1) insert names of other Division 27 consultants and their associated specification sections and drawing series

12. Drawings – The part of the Contract Documents prepared or approved by Design Consultant which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
13. General Requirements – Sections of Division 1 of the Specifications.
14. Laws and Regulations – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
15. Notice to Proceed – a written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
16. Owner – the individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
17. Project – the total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
18. Samples – physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which established the standards by which such portion of the Work will be judged.
19. Seismic Design Category – a category from ASCE 07 assigned to a structure based on its occupancy category and the severity of the design earthquake ground motion at the Project Site.
20. Shop Drawings – all drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
21. Site – lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of the Contractor.
22. Specifications – the part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
23. Subcontractor – an individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
24. Substantial Completion – the time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of the Architect/Design Consultant, the Work is sufficiently complete, in accordance with the Contract Documents, so that the Work can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
25. Supplementary Conditions – the part of the Contract Documents which amends or supplements these General Conditions.
26. Supplier – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
27. Underground Facilities – all underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing

such facilities, including those that convey electricity, gases, steam, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

28. Work – the entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

B. Terminology

1. The words and terms below are not defined, but when used in Division 27 specifications and related Drawings, have the indicated meaning:

a. Intent of Certain Terms and Adjectives:

1) The Contract Documents include the terms “as allowed,” “as approved,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Design Consultant. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Design Consultant as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Design Consultant any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the following provisions or any other provision of the Contract Documents.

a) Limitations on Design Consultant’s Authority and Responsibilities

i) Design Consultant will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Design Consultant will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

ii) Design Consultant will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

b. Day – the word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

c. Defective – the word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:

1) Does not conform to the Contract Documents; or
2) Does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
3) Has been damaged prior to Substantial Completion.

d. Furnish – the word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

e. Install – the word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

f. Provide – the word “provides” and “perform,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

g. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied, and those services, materials and equipment shall be furnished and installed.

C. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contractor Documents in accordance with such recognized meaning.

D. Refer to individual sections for additional definitions.

1.6 REFERENCE STANDARDS

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.

2. For referenced standards and guidelines that have not been adopted into code or law, the most recent version / edition of the standard and guideline shall be followed, except for the following:

a. where the Contract Documents clearly establish size, quantity, and/or quality of services, materials, or equipment and/or the means, methods, techniques, sequences, or procedures of construction; in these instances, Contract Documents requirements shall take precedence.

3. Whenever the Contract Documents details a requirement that violates an adopted code, law or regulation, submit RFI to Architect/Design Consultant prior to Bid or performing the Work.

B. Codes and Regulations

1. The following codes, laws and regulations are known to have requirements that affect Communications Systems and are listed here for reference. Refer to Part 1 Coordination paragraph in this section for requirements when there are any discrepancies between these codes, laws and regulations and the Contract Documents.

a. 2010 ADA Standards for Accessible Design

b. ASCE 07 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures

c. FCC Rules and Regulations

d. National Electric Safety Code

e. NFPA 70 – National Electric Code

f. NFPA 72 – National Fire Alarm and Signaling Code

g. NFPA 99 – Health Care Facilities Code

h. NFPA 101 – Life Safety Code

i. 2012 Texas Accessibility Standards

2. Refer to individual sections for additional requirements.

1. QUALITY ASSURANCE

A. Contractor Qualifications

1. Refer to individual sections for requirements.

B. Personnel Qualifications

1. At all times during the progress of the Work, Contractor or Subcontractor shall assign a competent Project Manager who shall not be replaced without written notice to Owner and Design Consultant except under extraordinary circumstances.

2. Refer to individual sections for additional requirements.

1. ARRANTY

A. Contractor's General Warranty and Guarantee

1. If the General Requirements do not establish Contractor's General Warranty and Guarantee, then the following requirements are in effect for Communications Systems Work:

a. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Design Consultant and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

b. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1) abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
2) normal wear and tear under normal usage.

c. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1) observations by Design Consultant.
2) recommendation by the Architect/Design Consultant or payment by Owner of any progress or final payment.
3) the issuance of a certificate of Substantial Completion by Architect/Design Consultant or any payment related thereto by Owner.
4) use or occupancy of the Work or any part thereof by Owner.
5) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Design Consultant;
6) any inspection, test, or approval by others; or
7) any correction of defective Work by Owner.

B. Manufacturer Warranty

1. Refer to individual sections for additional requirements.

C. Special Warranty

1. Refer to individual sections for additional requirements.

1.9 SUBMITTALS

A. General Submittal Requirements:

1. Refer to General Requirements (Division 1) for general submittal requirements. Refer to individual sections in Division 27 for additional requirements.
2. Submittals and Shop Drawings shall not utilize the Design Consultant's logo, stamp, or the title block from the Construction Drawings; if either of these are submitted, the Submittal(s) will be rejected without review.
3. Inadequate or Incomplete Submittals and/or Shop Drawings will not be reviewed and will be returned to the Contractor.

B. Pre-Bid

1. Pre-Bid submittals can generally include:
   a. Clarifying questions.
   b. Product Substitution requests.
   c. Contractor and personnel qualification documentation.
2. Refer to individual sections for specific Pre-Bid requirements.

C. Bid

1. Refer to General Requirements for Bid Form and other requirements.
2. Refer to individual sections for additional Division 27 requirements due with Bid, which may include – but is not limited to – the following:
   a. Contractor and personnel qualification documentation
   b. Unit Pricing
   c. Allowance(s)

D. Pre-Construction

1. Procedures:
   a. Before submitting Pre-Construction submittals, Contractor shall have:
      1) reviewed and coordinated each Shop Drawing with other Shop Drawings and with the requirements of the Work and the Contract Documents.
      2) determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto.
      3) determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
      4) determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions, pre-construction meeting, and programs incident thereto.
   b. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
   c. With each submittal, Contractor shall give Design Consultant specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separates from the Shop Drawings or submittal; and, in addition, by a specific notation made on each Shop Drawing submitted to Design Consultant for review and approval of each such variation.
   d. Design Consultant's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents.

e. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.

f. Contractor shall not install any equipment until pre-construction meeting with Architect/Design Consultant/FBISD IT Department

g. Contractor shall ensure submittals are submitted in a timely manner to ensure all products can be ordered and received on site in order to not cause any delays. If there are any concerns with any products having long lead times, those products shall be clearly identified in writing so the review and approval can be expedited.

h. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e., product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will be returned unreviewed.

2. Bill-of-Materials / Product Index

a. Provide a typed listed with each product/equipment being provided as part each Section. List shall include the following, in the exact same order as listed in Division 27 specifications:

1) Product/Equipment specification name
2) Manufacturer
3) Model name
4) Model number

3. Product Data

a. Provide product data sheet for each material, equipment, device, etc. listed in Part 2 of these specifications. Data sheet shall include manufacturer name, product name, part number and relevant product specifications in an 8.5”x11” PDF format.

b. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified may not be approved.

4. Shop Drawings

a. Shop Drawings shall include the following:

1) Contractor or Subcontractor’s titleblock; drawing size shall match Construction Drawings (ie 30” x 42”). Titleblock shall include:

a) Project name and address

b) Contractor/Subcontractor company name and contact information.

c) Name and contact information of Contractor/Subcontractor’s Project Manager.

2) Shop Drawings shall be produced in Revit, AutoCAD 2013 or higher.

a) No scanned copy

b) Both construction and graphics room number

c) Reference related spec section for additional requirements

3) Legend page with all symbols defined.
4) Floors plans (minimum scale of 1/8” = 1’-0”) for all areas with Division 27 Work. Floor plans shall include north arrow, keyplan, and indicate device/equipment locations, and associated pathway routing and size.
5) Enlarged plans (minimum scale of 1/4" = 1’-0”) and rack and wall elevations for

Communications Rooms, Equipment Rooms, etc., indicating exact location where equipment is intended to be installed. Enlarged plans shall include north arrow.

6) Riser diagrams, details, coordination views, etc. to indicate Contractor has a full understanding of required Work and is coordinated with other trades.

b. Where installation location is critical – such as in Communications Rooms and Equipment Rooms, as well as outlet/device location height above finished floor – indicate figured dimension on Shop Drawings.

c. Refer to individual sections for additional Shop Drawing requirements.

5. Samples

a. Refer to individual sections for requirements.

6. Certificates

a. Refer to individual sections for requirements.

E. Refer to individual sections for additional Pre-Construction Submittal requirements.

1.1 PRO ECT CLOSEOUT

A. Include □□□□□ □□□ □ in Preliminary Project Closeout Submittal (a minimum of two weeks before Final Site Observation) to facilitate Final Site Observation by Design Consultant.

B. Bill-of-Materials / Product Index – Update Bill-of-Materials that was included in the Pre-Construction Submittal with actual equipment installed. Include columns populated with the following information:

1. Product Name (from Specifications)
2. Manufacturer
3. Model Number
4. Quantity installed on project
5. Manufacturer Warranty period (if longer than one year)

C. Product Data (Cutsheets)

1. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

D. Operation and Maintenance Data

1. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

E. Warranty Documentation

1. Include PDF copy of any Warranty documentation and/or certifications that came with the installed products or required by these Specifications.
2. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

F. Test Results

1. Include PDF copy of Functional Test Reports for each section.
2. Refer to individual sections for testing requirements.

G. Spare Parts and Tools

1. At time of Owner Training, furnish any and all spare parts and tools to the Owner that are required by the Contract Documents.
2. In the Project Closeout Submittal, include PDF copy of delivery receipt, indicating items and quantities that were furnished to the Owner, as well as the date, time, and Owner Representative that took possession of the items.

3. Refer to individual sections for additional requirements.

H. Record Drawings (“As Builts”)

1. Maintain a copy of approved Submittals, Shop Drawings, and Change Orders on the Site (or the Project’s Construction Administration website), and update with changes during construction. Any minor changes to the Drawings shall be updated on a weekly basis. These drawings shall be made available for inspection at any point during construction when requested by the Architect / Design Consultant.

2. At the conclusion of the project, utilize AutoCAD or BIM software (such as Revit or Navisworks) to incorporate the changes to the Shop Drawings.

   a. PDF markups in software such as Bluebeam will not be acceptable.

3. As-Built drawings shall be produced in AutoCAD 2013 or higher and provided in hardcopy and electronically in .dwg and PDF format. Provide (1) laminated copy ARCH C (18” X 24”) in each MDF/IDF.

4. Include both PDF and AutoCAD (2013 dwg file type) versions of every drawing in the Project Closeout Submittal.

   a. PDF needs to be an original, provided to the district not a photocopy converted.

5. Hardcopy drawings shall be provided in the original size as issued by the Architect/Design Consultant.

   a. Drawings need to have the final room numbers not construction room numbers.

   b. Drawings should have the network drop name at the user locations in the As-builds.

   c. PDF needs to be an original provided to the district not a photocopy converted.

6. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.

7. Refer to individual sections for additional requirements.

I. Special Requirements – Refer to individual sections for additional requirements.

1.11 COORDINATION

A. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to the Architect/Design Consultant any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from the Architect/Design Consultant before proceeding with any Work affected thereby.

B. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to the Architect/Design Consultant in writing. Contractor shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued.

C. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

D. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

E. Refer to General Requirements / Division 1 for Schedule requirements. Subcontractors for Division 27 Work shall coordinate with Contractor in establishing schedules and timetables to perform the Work and perform that Work per those established schedules.

F. The Contractor/Subcontractor for each Division 27 Section shall maintain a Project Manager (per the Quality Assurance paragraph of that Section) that is on the jobsite whenever Work for that Section is being performed. This Project Manager shall coordinate the Work with other trades, such that Division 27 Work is installed per the Schedule, with the required clearances for all Divisions of Work, and meets the required codes and standards.

G. Division 27 Work shall not impair, hinder, or delay Work of other trades.

H. Before starting Work, examine adjacent Work performed by other divisions (trades) to determine if there are any conditions that would be detrimental or prevent Division 27 Work from being a successful installation. Notify issues to Contractor for remediation prior to starting Work.

I. Unless otherwise indicated with a figured dimension, Drawings are schematic - indicating approximate location of devices and equipment. Communications devices and equipment may be figure-dimensioned on the Architectural Drawings, which take precedence over the approximate locations on the technology Drawings. Where neither Architectural or technology Drawings include a figured dimension, exact location shall be determined by scaled dimension and coordination with requirements of other trades. Errors that could have been avoided by proper coordination shall be corrected without additional costs to the Owner.

J. Coordination with other Divisions

1. Division 21 Fire Suppression – ensure no piping is routed overhead through a Communications Room or Equipment Room, except where serving a fire suppression device in the Communications/Equipment Room.

2. Division 22 Plumbing – ensure no piping is routed overhead through a Communications Room or Equipment Room.

3. Division 23 Mechanical – ensure no piping or ductwork is routed overhead through a Communications Room or Equipment Room, except where serving Mechanical equipment in the Communications/Equipment Room.

4. Division 26 Electrical

   a. Ensure no conduits are routed overhead through a Communications Room or Equipment Room, except where serving an Electrical panelboard or receptacles in the Communications/Equipment Room.

   b. Coordinate exact location of receptacles / hard-wired circuits for Division 27 equipment with Division 26 Contractor prior to rough-in installation.

   c. Prior to connecting Division 27 devices and equipment to an electrical receptacle, utilize a ground circuit impedance tester to detect any wiring errors and low equipment ground impedances. If any issues are detected, notify Division 26 Contractor for correction prior connecting Division 27 devices and equipment.

5. Refer to individual sections for additional coordination requirements.

K. Preinstallation Meetings

1. Refer to individual sections for additional requirements.

L. Sequencing / Scheduling

1. Refer to individual sections for specific sequencing / scheduling requirements.

1.12 STRUCTURAL REQUIREMENTS

A. For equipment in excess of 200 pounds that is attached to overhead structure, additional structural design analysis is required to confirm overhead structure can support the equipment weight and to determine supports and connection types. This design analysis is Delegated Design, to be completed by the Contractor's structural engineer. The cost of the Delegated Design and required supports and connection types for Communications Systems shall be included in the Contractor's Bid.

B. Structural Analysis Requirements

1. Structural analysis shall be performed by a structural engineer licensed in the state of the Project. Delegated Design submittals and Shop Drawings shall be stamped by this structural engineer.

1.13 PATENT FEES ROYALTIES PERMITS AND TAXES

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others.

B. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

C. Unless otherwise provided in the Supplementary Conditions, Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

1.14 DELEGATION OF PROFESSIONAL DESIGN SERVICES

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Design Consultant will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Design Consultant.

C. Owner and Design Consultant shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Design Consultant have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph, Design Consultant's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Materials and equipment incorporated into the Work shall be as specified and of good quality and new, except as otherwise noted in the Contractor Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by these specifications or when requested by the Owner or Design Consultant, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

B. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

C. Performance Criteria

1. Regulatory Requirements

a. Utilize products listed by a National Recognized Testing Laboratory (such as UL), except where no relevant standard exists. These products shall bear a permanent mark/label of the NRTL.

b. All equipment and material used in the installation shall be listed for the environment in which it is being installed. Examples – plenum-rated where installed in a return air plenum; wet or outdoor listed where installed in Wet or Damp Locations.

c. Refer to individual sections and products for specific NRTL requirements.

2. Sustainability Characteristics

a. Refer to General Requirements / Division 1 for general Project and Product Sustainability requirements.

b. Refer to individual Division 27 sections and products for specific Sustainability requirements.

D. Lead Time Issues

1. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect/Design Consultant prior to submitting a Bid for this work. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the Work as required.

E. In the event a manufacturer’s specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer’s part number.

F. In the event of a discrepancy between these Specifications and the Drawings, the greater quantity and/or better quality shall be assumed for Bidding purposes.

2.2 SUBSTITUTES AND “OR EQUALS”

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to the Architect/Design Consultant for review under the circumstances described below.

1. “Or-Equal” Items: If in the Design Consultant’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Design Consultant as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

    a. In the exercise of reasonable judgment, the Design Consultant determines that:

        1) It is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics.
        2) It will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
        3) It has a proven record of performance and availability of responsive service.

    b. Contractor certifies that, if approved and incorporated into the Work

        1) There will be no increase in cost to the Owner or increase in Contract Times: and
        2) It will confirm substantially to the detailed requirements of the item named in the Contract Documents.
        3) The item's functionality and operation are comparable or more user-friendly.

2. Substitute Items:

    a. If in the Design Consultant’s sole discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under the Paragraph above, it will be considered a proposed substitute item.

    b. Contractor shall submit sufficient information as provided below to allow Design Consultant to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by the Design Consultant from anyone other than Contractor.

    c. Contractor shall make written application to the Architect/Design Consultant for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

        1) shall certify that the proposed substitute item will:

            a) perform adequately the functions and achieve the results called for by the general design,

            b) be similar in substance to that specified, and

            c) be suited to the same use as that specified.

        2) will state:

            a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor’s achievement of Substantial Completion on time,

            b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

            c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

        3) will identify:

            a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

d. Cost Reimbursement: in certain situations, evaluating a proposed substitution will require additional time by the Design Consultant. These situations will either be described in subsequent Specification sections or conveyed in writing to the Contractor prior to evaluation by the Design Consultant. Design Consultant will record Design Consultant's costs in evaluating the proposed substitution. Whether or not Design Consultant approves the proposed substitution, Contractor shall reimburse Owner for the reasonable charges of Design Consultant for evaluating each proposed substitute. Contractor shall also reimburse Owner for the reasonable costs for Design Consultant, Architect, and Engineer(s) in making changes in the Contract Documents resulting from the acceptance of each proposed substitute.

B. Proposed equivalent items shall be approved by Design Consultant prior to purchase or installation. Proposed equivalent items shall meet or exceed these specifications and the specifications of the specified item.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verification of Conditions

1. Prior to submitting a Bid, visit the project Site and existing facility (facilities) and become familiar with the conditions affecting the proposed scope of Work. Make provisions as to the cost associated with the existing conditions and include those costs in the Bid.

2. Existing Interior Conditions

a. Refer to Existing Conditions paragraph in Part 1 of this Section.

3. Underground Facilities

a. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Communications Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Design Consultant by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1) Owner and Design Consultant shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2) the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a) reviewing and checking all such information and data.

b) locating all Underground Facilities shown or indicated in the Contract Documents.

c) coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d) the safety and protection of all such Underground Facilities and repairing any damage

e) thereto resulting from the Work.

b. Not Shown or Indicated:

1) If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Architect/Design Consultant. Architect/Design Consultant will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

B. Preinstallation Testing

1. Refer to individual sections for requirements.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

D. No deviations from the Contract Documents shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Contractor prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. Cleaning

1. During the progress of the Work, Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations. Contractor shall dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner’s facilities for the disposal of excess or scrap materials.

2. Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

F. Protection

1. The Contractor shall protect Communications Work from damage by other trades and theft.

a. Any Division 27 cabling that has more than 3-inches of paint on the jacket shall be replaced without additional cost to the Owner.

2. Where owner-furnished or provided equipment is installed prior to Substantial Completion, access to that room or area shall be restricted/locked whenever unoccupied.

G. Power

1. Prior to connecting any Communications equipment to a power receptacle, use a ground circuit impedance tester to confirm AC wiring and grounding has been installed correctly; confirm voltage and neutral-to-ground wiring are correct prior to energizing equipment. If not correct, notify Division 26 Contractor of the issue.

H. Temporary Power, HVAC, and Communications Systems

1. Where owner-furnished or provided network equipment is required to be installed prior to Substantial Completion in order for Communications Systems Work to be functional, the room or area where that network equipment is installed shall be equipped with permanent or

temporary power and heating/cooling at no additional costs to the Owner. Acceptable temperature range is 60 to 89 degrees Fahrenheit.

2. When, through no fault of the Owner or Architect/Design Consultant, Communications Systems Work is not completed by Substantial Completion, temporary Communications Systems may be required while the Site is partially occupied by the Owner and shall remain installed until acceptance of permanent system(s); refer to individual sections for requirements.

3.2 INTEGRATION REQUIREMENTS

A. Refer to individual sections for integration requirements.

3.3 REPAIR RESTORATION

A. Contractor shall be responsible for the repair of any damage caused by the Contractor or Subcontractors during the installation.

B. Selective demolition may be necessary to facilitate installation of Communications Systems equipment and pathways. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings. After installation, Contractor shall restore floors, walls, roofs, and ceilings to their original condition.

1. Avoid penetrations or installation of equipment onto or through waterproof assemblies such as roofs, exterior walls, and slab-on-grade floors. If installation cannot be avoided, install before waterproofing; protect installation area from weather/elements until sealing and waterproofing is complete.

3.4 FUNCTIONAL AND PERFORMANCE TESTING

A. After components have been installed, perform functional tests to ensure system components are installed and configured correctly in conformance with manufacturer’s instruction and the Contract Documents. Correct any issues and retest. Include Test Report documentation in Preliminary and Final Project Closeout Submittals.

B. Third-party testing or manufacturer onsite services may be necessary for certain Division 27 systems or sub-systems; refer to individual sections for exact requirements.

C. Refer to individual sections for additional testing requirements.

3.5 FIELD OBSERVATIONS

A. A minimum of two weeks in advance, notify Design Consultant and Owner as to the readiness for a Field Observation for the following:

1. Rough-In Observation – after conduits have been installed, but before walls have been installed.

2. Above Ceiling Observation – after cabling has been installed, but before ceilings have been installed.

3. Final Site Observation – a minimum of two weeks before Substantial Completion, to occur after Preliminary Project Closeout Submittal has been submitted.

B. Non-Conforming Work

1. After receipt of written notice of defective Work, Contractor shall correct all defective Work, or, if the Work has been rejected by the Architect/Design Consultant, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages arising out of or relating to such correction or removal.

3.6 DEMONSTRATION TRAINING AND AD USTMENTS

A. Conduct training sessions to Owner's personnel to demonstrate system operation and preventative maintenance procedures.

1. Refer to individual sections for additional training requirements.

B. After Owner has taken occupancy, Communications Systems equipment and components may require minor adjustments to be performed by the Contractor/Subcontractor to align with Owner's actual use of the systems. Refer to individual sections for specific adjustment requirements.

3. SOFT ARE NET OR AND CYBERSECURITY REQUIREMENTS

A. Software Requirements

1. All firmware found in products furnished or provided by the Contractor shall be the latest and most up-to-date provided by the manufacturer.

2. All equipment requiring users to log on using a password shall be configured with user/site-specific password(s). No system/product default passwords shall be allowed. Coordinate user logins and passwords with Owner prior to system setup.

3. Refer to individual sections for additional software requirements.

B. Network and Cybersecurity Requirements

1. For all Communications Systems that have Contractor-provided equipment with an Ethernet/LAN port, Contractor shall coordinate with Owner's IT staff regarding Owner's network and cyber security requirements.

2. Within two weeks after Notice to Proceed, the Contractor (and/or Subcontractors for each Communications System) shall request an IT Coordination Kickoff Meeting with Owner's IT staff to ascertain and document Owner's requirements. Contractor shall document this meeting and send meeting minutes to all parties in attendance as well as Architect/Design Consultant.

3. At a minimum, coordinate the following network requirements for Contractor-provided equipment with the Owner's IT staff:

a. IP address quantities and assignments for each equipment type and location, including subnets and subnet masks.

b. PoE quantities and power requirements (PoE, PoE , high powered PoE, etc) for each equipment type and location.

c. Bandwidth requirements, including any prioritization or unicast/multicast requirements.

d. VLAN use and assignment

e. Encryption requirements

f. WAN connection requirements

g. Firewalls

h. Planned approach for software upgrades and security patching.

i. Follow additional network requirements and procedures as directed by the Owner's IT staff.

4. The Contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owner's technology infrastructure and network. These measures shall include but are not limited to:

a. The Contractor shall scan contractor-provided or furnished equipment for cyber threats such as viruses, malware, ransomware, etc., prior to connecting the equipment to the Owner's network.

b. Coordinate with the manufacturer to ensure newly procured equipment does not have any cybersecurity notices, bulletins, or alerts. Provide a letter to the Design Consultant with the submittal documents for that Specification section confirming there are no active or known cyber threats.

c. Ensure all installers/technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics.

d. The Contractor shall assess whether or not there are any cyber threats / vulnerabilities associated with the specified equipment, prior to procurement/installation. If cyberthreats are discovered, notify the Design Consultant within one Day. Provide the make and model of the associated equipment and the vulnerability.

e. Follow additional cybersecurity requirements and procedures as directed by the Owner's IT staff.

5. Refer to individual sections for additional Networking and Cybersecurity Requirements.

3. MAINTENANCE

A. Warranty Service

1. Pursuant to Contractor's General Warranty and Guarantee, Owner may request Warranty Service for a period of 1 year after Substantial Completion for Communications Systems components due to faulty material or installation.

2. Upon written notice from Owner, promptly perform remedial / corrective Work to bring the associated system(s) to compliance with the Contract Documents and satisfaction of the Owner.

a. In this context, "promptly" means within 7 Days, unless a quicker response and remediation time is specified in the associated Division 27 specification section.

3. Refer to individual sections for additional Warranty Service requirements.

B. One Year Warranty Check

1. 50 weeks after Substantial Completion, Contractor or Subcontractor for each Division 27 section shall conduct a site visit with Owner's facility personnel to ensure systems and components are still operating as intended / required by the Contract Documents. Promptly perform corrective Work while on site or within 7 Days.

a. Pursuant to Contractor's General Warranty and Guarantee, corrective Work is not required if system / component is deficient due to:

1) abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
2) normal wear and tear under normal usage.

3.9 DRA INGS AND SPECIFICATIONS AFTER SUBSTANTIAL COMPLETION

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by Combs Consulting Group, LP, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on any other project without written consent of COMBS Consulting Group, LP.

B. The prohibitions in the paragraph above survive final payment, or termination of Contract. Nothing herein shall preclude Contractor or Owner from retaining copies of the Contract Documents for record purposes.

C. Physical paper copies of Drawings and Specifications shall be properly destroyed (shredded) when no longer needed to perform the Work.

END OF SECTION

SECTION 2 5 33 - PATH AYS FOR COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section and the associated Technology (T Series) AudioVisual (TA Series), PA (TPA Series) and Security (TS Series) Drawings and Contract Documents identify the requirements, technical design, and specifications for pathways for Communications Systems for the Project. The conduit and backboxes shall be in compliance with the latest version of TIA-569 and the locally adopted version of the NFPA 70 (National Electric Code) and shall include all components needed to ensure proper system performance and code compliance as specified.

B. Functionally complete pathways shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether or not specifically called for, at no additional cost to Owner.

C. The pathways for Communications Systems includes the following main components:

1. Conduit / Sleeves and accessories
2. Backboxes
3. Floorboxes / Poke Thru Devices
4. Pullboxes (Junction Boxes)
5. Wire-mesh Cable Tray
6. Surface Raceways and Boxes
7. Firestopping Systems
8. Labeling

1.2 RELATED SECTIONS

A. Work required by this Section shall meet the requirements of Section 27 00 10 General Requirements for Communications.

B. Refer to Division 26 for Electrical System requirements, including but not limited to additional material and installation requirements for Communications Systems conduit, backboxes, floorboxes, and pullboxes.

C. Refer to Section 27 00 10 for associated General Requirements for Communications

D. Refer to Section 27 10 00 for associated Structured Cabling requirements

E. Refer to Section 28 13 00 for associated Access Control System

F. Refer to Section 28 23 00 for associated Video Surveillance System

1.3 CONFIDENTIALITY

A. Refer to Section 27 00 10 for confidentiality requirements.

1.4 ABBREVIATIONS

A. NECA – National Electrical Contractors Association

B. NEMA – National Electrical Manufacturers Association

C. Refer to Section 27 00 10 for additional abbreviations.

1.5 DEFINITIONS

A. Transition Point Enclosure

B. Refer to Section 27 00 10 for additional definitions.

1.6 REFERENCE STANDARDS

A. Codes and Regulations

1. Refer to Section 27 00 10 for additional Codes and Regulations.

B. Standards

1. NECA 1 – Standard for Good Workmanship in Electrical Construction
2. NECA/BICSI 568 - Installing Commercial Building Telecommunications Cabling
3. NECA/BICSI 607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
4. TIA 569 – Telecommunications Pathways and Spaces
5. TIA 606 – Administration Standard for Telecommunications Infrastructure
6. TIA 607 – Generic Telecommunications Bonding and Grounding for Customer Premises
7. Refer to Section 27 00 10 for additional Standards.

C. Guidelines

1. BICSI – Telecommunications Distribution Methods Manual
2. NEMA VE 2 - Metal Cable Tray Installation Guidelines
3. Refer to Section 27 00 10 for additional Guidelines.

1. QUALITY ASSURANCE

A. Contractor Qualifications

1. The Contractor shall be a Panduit Gold Certified.
2. The Contractor shall have been in business for a minimum of five (5) years.
3. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project Site.
4. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.
5. The Contractor shall have a minimum of (2) certified BICSI and Panduit certified installers, full-time employees of the company and on onsite at all times.
6. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.
7. Firestopping Contractor Qualifications

a. Firestopping materials shall be part of a UL listed System and installed by a certified technician.
b. Contractor / Subcontractor installing Firestopping shall be qualified and properly trained, with at least one of the following certifications:

1) FCIA (Firestop Contractors International Association) – FM 4991 Approval
2) UL Qualified Firestop Contractor
3) Installation Certification through firestopping manufacturer.

a) Specified Technologies, Inc products – all installers shall be FIT Level 1 Certified through STI.

b) Hilti products – Contractor / Subcontractor shall be part of Hilti Firestop Specialty Contractor Program

c) Or Approved Equivalent

c. Submit proof of certification as part of Pre-Construction Submittal.

8. Refer to Section 27 00 10 for additional Contractor Qualifications requirements.

B. Personnel Qualifications

1. At all times during the progress of the Work, Contractor (or Subcontractor) responsible for the Work of this Section shall assign a competent Project Manager with the following qualifications / credentials:

a. A minimum of five years of experience overseeing installation of Communications Pathways and who is familiar with the requirements of TIA and BICSI Reference Standards listed above.

2. Include resume(s) of the above personnel per Submittal requirements and when requested by Owner or Design Consultant.

C. Site Observations

1. Contractor's RCDD (per Section 27 10 00 Structured Cabling) shall make weekly inspections during construction to ensure Pathways for Structured Cabling are installed properly and per the Contract Documents.
2. Contractor's CTS-I/CTS-D (per Section 274 1 00 Audio Visual Systems) shall make weekly inspections during construction to ensure Pathways for Audio Visual Systems are installed properly and per the Contract Documents.

1. ARRANTY

A. Refer to 27 00 10 for General Warranty requirements.

B. Manufacturer Warranty

1. Panduit Manufacturer's 25-Year Performance Certification for the installed structured cabling system.

C. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

a. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor, and workmanship starting at final system acceptance.
b. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e., Contractor name, Point of Contact, address, phone number, and email address) and start and end date for warranty call outs.

D. Special Warranty

1. No special warranty is required for Pathways for Communications Systems.

1.9 SUBMITTALS

A. Refer to Section 27 00 10 for General Submittal Requirements.

B. Pre-Bid

1. Submit clarifying questions and product Substitution Requests prior to the questions deadline prior to Bid.
2. Submit Contractor and Personnel Qualifications documentation indicating that the requirements of the Quality Assurance paragraph of this Section and Section 27 00 10 are met.

C. Bid

1. Refer to Section 27 00 10 for general Bid requirements.

D. Pre-Construction

1. Refer to Section 27 00 10 for general Pre-Construction Submittal requirements and procedures.
2. Pre-Construction Submittal for this Section shall include the following:
    a. Bill-of-Materials
    b. Product Data
    c. Firestopping UL System information
    d. Shop Drawings
        1) Refer to Section 27 00 10 for general Shop Drawing Requirements
        2) Shop Drawings for Work of this Section shall also include:
            a) Floor plans showing the following work:
                i) Cable tray routing, size and height AFF. Cloud minor changes from Drawings and indicate reason for minor deviation – ie “Routed on west side of corridor due to conflict with mechanical duct.” Submit RFI for major changes in routing – ie when coordination issues require cable tray to be routed in different room.
                ii) Dimensioned multi-service floor box and poke thru device locations. For slab-on-grade floor boxes, also indicate quantity, size and routing of conduit under/in slab to serving Communications Room (for Structured Cabling) and to rack or accessible ceiling space (for Audio Visual).
            b) Pathways for Structured Cabling (including firestopping requirements identified by UL System number) shall be identified on Section 27 10 00 Shop Drawings.
            c) Pathways for Audio-Visual Systems (including firestopping requirements identified by UL System number) shall be identified on Section 27 41 00 Shop Drawings.
            d) Pathways for Paging Systems (including firestopping requirements identified by UL System number) shall be identified on Section 27 51 00 Shop Drawings.

1.1 PRO ECT CLOSEOUT

A. Refer to Section 27 00 10 for general Project Closeout submittal requirements.

B. Project Closeout submittal for this Section shall include the following:

1. Bill-of-Materials / Product Index
2. Product Data
3. Operation and Maintenance Data
4. Warranty Documentation
5. Test Results
6. Training and Spare Parts
    a. Signed acceptance letter or form indicated Owner has been properly trained in operation of the system and has taken possession of the specified Spare Parts and Tools (items listed as “Furnish to Owner”).
7. Record Drawings (“As Builts”)
    a. Maintain a copy of approved Shop Drawings on the Site (or the Project’s Construction Administration website), and update changes to pathways made during construction.
    b. At the conclusion of the project, utilize AutoCAD or BIM software (such as Revit or Navisworks) to incorporate the pathway changes to the Shop Drawings.

c. PDF markups in software such as Bluebeam will not be acceptable.
d. As-Built drawings shall be produced in AutoCAD 2013 or higher and provided in hardcopy and electronically in .dwg and PDF format. Provide (1) laminated copy ARCH C (18” X 24”) in each MDF/IDF.
e. Drawings need to have the final room numbers not construction room numbers.
f. Drawings should have the network drop name at the user locations in the As-builds.
g. PDF needs to be an original provided to the district not a photocopy converted.
h. Include both PDF and AutoCAD (2010 dwg file type) versions of every drawing in the Project Closeout Submittal.

1.11 COORDINATION

A. Refer to Section 27 00 10 for general Coordination requirements.

B. Coordination with other Divisions and Sections

1. Coordinate routing of cable tray with other trades prior to construction. Installation of cable tray without required clearances will not be accepted. Include in Bid cost of minor cable tray routing adjustments (within the same corridor) due to conflicts with other trades.

C. Preinstallation Meeting

1. After Bid and before Preconstruction Submittals, request a Preinstallation Meeting with General Contractor and other Division 27 and 28 Subcontractors regarding Work specified in this Section.

1.12 STRUCTURAL AND SEISMIC REQUIREMENTS

A. Refer to Section 27 00 10 for structural and seismic requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Refer to Section 27 00 10 for general product requirements.

2.2 CONDUIT SLEEVES AND ACCESSORIES

A. Electric Metallic Tubing (EMT) and fittings

1. Refer to Division 26 for specific product and material requirements.
2. Shall meet ANSI C80.3, UL 797
3. Manufacturers:

a. Allied Tube or equivalent

B. Intermediate Metal Conduit (IMC) and fittings

1. Refer to Division 26 for specific product and material requirements.
2. Shall meet ANSI C80.6, UL 1242
3. Manufacturers:

a. Allied Tube or equivalent

C. Rigid Metallic Conduit (RMC) and fittings

1. Refer to Division 26 for specific product and material requirements.
2. Shall meet ANSI C80.1, UL 6
3. Manufacturers:

a. Allied Tube or equivalent

D. Conduit Support / Fittings / Accessories

1. Conduit Clamps
    a. Caddy Screw On Conduit Clips – For 1-inch – Part No. CS16
    b. Or equal
2. 1-5/8” Framing System
    a. Unistrut Support Channel – Part No. P1000 T
    b. Or equal
3. Conduit Bushings
    a. Nylon Bushings Sized for the Conduit Installed
4. Innerduct
    a. Install size and type as identified on Drawings.
    b. 1” or 1-1/4” diameter
    c. Composed of HDPE (High Density Polyethylene)
    d. UL listed for Riser Plenum installation
    e. Footage markings every two feet
    f. With pull tape preinstalled
    g. Manufacturer:
        1) Innerduct
        2) Carlon
        3) Panduit
5. Fabric Innerduct - must use a swivel head(s) for installation.
    a. Textile innerduct
    b. Type (cell size and quantity) as identified on Drawings and 27 10 00 Specification.
    c. UL listed for Riser installation
    d. With pull tape preinstalled in each cell
    e. Manufacturer:
        1) MaxCell
        2) No Substitutions

2.3 BAC BOXES

A. Size, Gang, and Trim Ring per Drawings

B. Boxes installed into stud walls:

1. Single gang:
    a. 2” by 3” by 2-1/2” deep
    b. Manufacturer:
        1) RACO xxx
        2) Or equal from: xxx
2. Double gang:
    a. 4-11/16” by 4-11/16” by 2-1/8” deep
    b. With a minimum of 3/8” deep trim ring; depth to match thickness of gypboard wall material.
    c. Manufacturer:
        1) RACO xxx
        2) Or equal from: xxx
3. TV Display backbox:
    a. Specialty in-wall backbox

b. Minimum dimensions: 7” tall by 14.25” wide by 3.9” deep
c. With (2) 1-gang knockouts in top for power receptacle and data outlet
d. With a minimum of (1) 1-1/4” knockouts in top and bottom for AV conduits
e. With white black cover with slot openings for cables and ventilation
f. Manufacturer:

1) Chief PAC525FC
2) FSR PWB-250
3) Or Approved Equal

4. TV Display backbox – shallow depth

a. Specialty in-wall backbox
b. Minimum dimensions: 7” tall by 14.25” wide
c. Maximum depth: 3”
d. With (2) 1-gang knockouts in top for power receptacle and data outlet
e. With a minimum of (1) 1-1/4” knockouts in top and bottom for AV conduits
f. With white black cover with slot openings for cables and ventilation
g. Manufacturer:

1) FSR PWB-253
2) Or Approved Equal

5. TV Display backbox – fire-rated wall

a. Specialty in-wall backbox
b. Minimum opening dimension: 10” by 8”
c. With (4) pre-wired electrical outlets (120V AC)
d. With (2) 1-1/2” knockouts in top and bottom for AV conduits
e. With white black cover with slot openings for cables and ventilation
f. With bracket to install Crestron RMC device
g. Manufacturer:

1) FSR PWB-FR-450
2) Or Approved Equal

C. Boxes installed into CMU (concrete masonry unit) walls:

1. Single gang:

a. 2” by 3” by 3-1/2” deep
b. Manufacturer:

1) RACO xxx
2) No substitutions

2. Double gang:

a. 2” by 3” by 3-1/2” deep
b. Manufacturer:

1) RACO xxx
2) No substitutions

D. Boxes installed in exterior / Wet locations:

1. Shall be die-cast aluminum - with watertight covers to fit installed size.
2. Manufacturer:

a. 1-gang: xxx
b. 2-gang: xxx

E. Specialty AV Backboxes

1. Size per Drawings

2. Boxes identified by Manufacturer and Model number represent the Basis-of-Design. Alternate manufacturers will be considered; submit Substitution Request in compliance with Division 1.

2.4 FLOORBOXES PO E THRU DEVICES

A. Multi-service Floor box – Power and Data only

1. Shall have a minimum of 4-gangs, with separate compartments for power and data.
2. Shall accept (1) (2) 1-inch 1-1/4-inch conduit(s) reserved for data cabling.
3. Stamped steel box, concrete-tight construction.
4. Shall maintain fire-rating of floor.
5. Provide power insert for every duplex indicated on Electrical Drawings.
6. Provide decora-style opening insert for every four data jacks on Technology Drawings.
7. Provide blank inserts for any unused gangs.
8. Coordinate cover plate style and type with Architect.
9. Manufacturer shall be:

    a. xxx

B. Multi-service Floor box – Power and Data only – Slab-on-Grade locations

1. Shall have a minimum of 4-gangs, with separate compartments for power and data.
2. Shall accept (1) (2) 1-inch 1-1/4-inch conduit(s) reserved for data cabling.
3. Cast iron box, watertight, Class 1 construction.
4. Provide power insert for every duplex indicated on Electrical Drawings.
5. Provide decora-style opening insert for every four data jacks on Technology Drawings.
6. Provide blank inserts for any unused gangs.
7. Coordinate cover plate style and type with Architect.
8. Manufacturer shall be:

    a. xxx

C. Multi-service Floor box – Shared Power, Data and Audio-Visual

1. Refer to Section 27 41 00 for AV Floor box requirements.

D. Multi-service Poke Thru Device – Power and Data only

1. 6-inch diameter flush-mounted poke thru
2. 2-inch conduit opening for
3. UL listed and UL fire classified to match rating of floor
4. Provide power insert for every duplex indicated on Electrical Drawings.
5. Provide decora-style opening insert for every four data jacks on Technology Drawings.
6. Provide blank inserts for any unused gangs.
7. Coordinate cover plate style and type with Architect.
8. Manufacturer shall be:

    a. Xxx

E. Multi-service Poke Thru Device – Shared Power, Data and Audio-Visual

1. Refer to Section 27 41 00 for AV Poke Thru Device requirements.

2.5 PULLBOXES UNCTION BOXES - NOT TO BE USED FOR CABLE PATH TURNS.

A. Sized per Part 3 of this Section

B. Metallic or steel construction

C. Removable cover. Boxes with a dimension greater than 24-inches shall have a hinged cover.

D. Interior locations: NEMA Type 1

E. Damp or Wet Locations (as defined by the NEC): NEMA Type 4

F. Manufacturer:

1. NEMA Enclosures
2. Hoffman
3. Custom NEMA enclosures from sheet metal shop / fabricator
4. Or equivalent

2.6 SURFACE RACE AYS AND BOXES - NOT TO BE USED FOR CABLE PATH TURNS.

A. Metallic Surface Raceways

1. Minimum cross-sectional area of low-voltage compartment shall be 1-square inch.
2. Manufacturer shall be:

a. Hubbell
b. Wiremold
c. Panduit
d. Monosystems

B. Metallic Surface Box

1. Single-gang or double-gang per Drawings
2. Minimum interior depth shall be 2-1/2-inches.
3. Manufacturer shall be:

a. Same as Metallic Surface Raceway

C. Non-metallic Surface Raceways

1. Minimum cross-sectional area of low-voltage compartment shall be 1-square inch.
2. Manufacturer shall be:

a. Hubbell
b. Wiremold
c. Panduit
d. Monosystems

D. Non-Metallic Surface Box

1. Single-gang or double-gang per Drawings
2. Minimum interior depth shall be 2-1/2-inches.
3. Manufacturer shall be:

a. Same as Non-Metallic Surface Raceway

2. IRE-MESH CABLE TRAY AND ACCESSORIES

A. Flexible, wire-mesh cable tray, with wire-mesh openings of approximately 2-inches by 4-inches, welded at all intersections.

B. UL listed as an equipment grounding conductor.

C. Contractor shall use associated hardware to provide solid support and grounding (sized appropriately according to manufacture specifications) to be used outside the MDF/IDF and a minimum of 20’ in any direction cabling trunks leave MDF/IDF.

D. Size per Drawings.

E. Utilize manufacturer-specific accessories as needed, including but not limited to:

1. Splice kits
2. Trapeze Support Brackets (center support brackets are not allowed)
3. 3/8-inch (or larger) threaded rod

4. Wall / Triangular Support Brackets
5. Split Bolt Grounding Clamp

F. Manufacturer:

1. Panduit
2. Or Approved Equivalent

2. FIRESTOPPING SYSTEMS

A. Fire-Rated Pathway Device (Sleeve)

1. Steel pathway (sleeve) with integral intumescent firestopping material to facilitate the initial installation - and frequent moves, adds, and changes - of low-voltage voice/data, fiber, video, security, paging, etc cabling.
2. UL System meeting the hourly fire-rating of the wall or floor type
3. Multiple pathways in the same location shall be ganged together.
4. Plenum-rated
5. Manufacturer:

a. Specified Technologies Inc – E Path Fire-Rated Pathway

1) 2” – Series 22
2) 3” – Series 33
3) 4” – Series 44

B. Firestopping for conduit penetrations

1. For metallic conduit or tube to be installed through 1 or 2 hr fire-rated wall or floor.
2. Manufacturer:

a. Gypsum board stud walls

1) Specified Technologies - UL System No. W-L-1222 with SpecSeal LCI Sealant
2) Or equivalent from Hilti

b. Concrete floors or walls

1) Specified Technologies – UL System No. C-AJ-1353 with SpecSeal LCI Sealant
2) Or equivalent from Hilti

C. Firestopping for backboxes in fire- or smoke-rated wall

1. For Communications backboxes to be installed in 1 or 2 hr fire-rated or smoke-rated walls.
2. STC sound rating – 64 or higher (related to specific construction)
3. Shall meet criteria of UL263 and classified for up to hrs as a Wall Opening Protective Material (Category CLIV)
4. Manufacturer:

a. Specified Technologies – SpecSeal Power Shield
b. Or equivalent from Hilti

D. Smoke-Rated or Acoustical Sleeves

1. Metallic or non-metallic pathway (sleeve) with integral self-adjusting smoke and sound sealing system to facilitate the initial installation – and frequent moves, ads, and changes – of low-voltage voice/data, fiber, video, security, paging, etch cabling.
2. L Rating – Air Leakage Test Procedure tested per UL1479 without a Fire Test
3. Less than 1.25 cubic feet per minute for 0% fill (cable) capacity
4. Less than 2.5 cubic feet per minute for 1 to 100% fill (cable) capacity
5. Sound Transmission Classification (STC) – 59 or higher (related to specific construction)
6. Plenum-rated
7. Manufacturer:

a. Specified Technologies Inc – NE Pathway
b. Hilti – Smoke and Acoustic Sleeve

E. Fire-rated Conduit (Circuit Integrity) Wrap

1. Endothermic wrap for EMT and RMC for protection of cable pathways for critical life safety circuits.
2. Tested to ASTM E1725 for circuit integrity
3. Manufacturer:

a. Specified Technologies – E-Wrap Endothermic Wrap

2.9 LABELS

A. Machine-printed, thermal-transfer type with self-adhesive

B. Text size for pathways shall be 3/8” tall.

C. Manufacturer:

1. Brady
2. Dymo
3. Hellermann Tyton
4. Panduit
5. Or equivalent

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. General pathway requirements have been identified in the Contract Documents through the use of general notes, key notes, symbols, details, and Division 27 specifications. Contractor is responsible for coordinating and providing required pathways to support all Division 27 Work in compliance with the Contract Documents. Coordinate exact pathway requirements with Subcontractors of all Division 27 Sections prior to Bid and include associated pathways in Bid.

B. Refer to Section 27 00 10 for additional installation requirements.

3.2 CONDUIT SLEEVES

A. The minimum size conduit shall be 1-inch.

B. EMT Conduit shall be used for all interior installations, unless otherwise noted.

1. Where service provider entrance conduits do not enter the building in the same room the service provider cables will be terminated, entrance conduit routed within the building shall be IMC.

C. PVC conduit shall only be installed in concrete or underground exterior of the building. Underground conduit bends and sweeps shall be IMC or RMC.

D. For exposed conduit routing in Damp or Wet Locations (as defined by the NEC) or parking garages, conduit type shall be IMC or RMC with water-tight fittings and backboxes.

E. Conduit shall be sized as indicated on the Technology drawings. If no conduit size is indicated, then conduits shall be a minimum of 1-inch in diameter and sized per TIA-569 – with maximum fill ratio of 40 percent.

F. Conduits shall not have more than the equivalent of (2) 90 degree bends or 180 degrees without the installation of a pullbox or hand hole.

G. For Interior Installations – conduits shall have a pull-box installed when the conduit exceeds 100 feet.

H. For Exterior Underground Installations – conduits shall have a hand hole or maintenance hole installed when the conduit exceeds 500 feet.

I. All conduits and sleeves shall be reamed after cutting to ensure there are no sharp edges or burrs on the conduit that could damage the cable.

J. All conduits and sleeves shall have a nylon bushing installed on the open end(s) of the conduit.

K. Conduits and sleeves shall not be shared with any other discipline unless specifically approved in writing by the Architect/Design Consultant.

L. Contractor is responsible for field coordination to ensure conduits and sleeves are separated from electrical conduits, and steam or hot water pipes: maintain a minimum clearance of 12-inches where routed parallel.

M. Unless indicated otherwise, all conduits shall be concealed under or within floor slabs, within finished walls, or above ceilings.

N. All conduits shall be installed parallel with or at right angles to ceilings, walls, and structural members.

O. Conduits shall be routed concealed in walls, above suspended ceilings, in concrete slabs, or below grade. Exposed conduit is allowed only in exposed-to-structure areas without suspended ceilings and where specifically noted by the Contract Documents.

P. Restrictions Applicable to EMT

1. Do not install underground.
2. Do not encase in concrete, mortar, grout, or other cementitious materials.
3. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
4. Do not use outdoors.

Q. Install and bond in accordance with NFPA 70 and TIA-569. In addition, bond telecommunications conduit in accordance with TIA-607.

1. Conduits that stub into Communications Rooms shall be bonded to Telecom Ground Bar in Communications Rooms. Utilize 6 AWG conductor for lengths up 13 feet, a 4 AWG conductor for lengths of 14 to 20 feet, and a 3 AWG conductor for lengths of 21 to 26 feet with listed two-hole compression or exothermic lugs at Ground Bar. Provide pipe grounding connector at conduit. Refer to TIA 607 standard for conductor size requirements for lengths longer than 26 feet.

R. Conduit Through Floor Slabs - Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

S. Directional Changes in Conduit Runs

1. Make changes in direction of runs with symmetrical bends
2. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits.
3. Prevent plaster, dirt, or trash from lodging in conduits, boxes and fittings during construction. Free clogged conduits of obstructions.

T. Sleeves through floors shall be rigidly supported utilizing a cast-in-place as the preferred method or using a unistrut rack system and shall extend through either side of the ceiling/floor a minimum of 4-inches.

U. Sleeves through walls shall be rigidly fastened to the studs and extend a minimum of 4-inches on either side.

V. Install each conduit longer than 5 feet with a nylon pull string with a minimum tensile strength of 200 lbs.

W. Conduit and Sleeve Supports

1. Support conduit and sleeves in underground installations using 2-inch duct spacers.
2. Support conduit and sleeves in interior installations using pipe straps, wall brackets, hangers, or ceiling trapeze.
3. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work.
4. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed.
5. Supporting means shall not be shared between telecommunication raceways and electrical raceway, mechanical piping or ducts.
6. Installation shall be coordinated with above-ceiling electrical and mechanical systems to assure maximum accessibility to all systems.
7. Conduit and sleeves shall be supported by a trapeze or wall support brackets.
8. A minimum of 3/8-inch all-thread shall be used for trapeze supports.
9. Support in accordance with NFPA 70 at intervals not to exceed three feet from the box and every 10 feet afterwards.
10. Conduit and sleeves shall be no less than 3-inches above a lay-in ceiling.
11. Conduit and sleeves shall be rigidly supported and level.
12. All supports shall attach to structure or a rigid surface.
13. Supports shall not be shared with any other discipline unless specifically approved by the Architect/Design Consultant.

X. Fabric Innerduct - must use a swivel head(s) for installation.

1. If Contractor has not previously installed fabric innerduct, contact Cody Albin prior to installation for free installation support offered by the manufacturer: cody.albin milliken.com, 512-388-7198.

3.3 BAC BOXES

A. Locknuts and Bushings

1. Fasten conduits to sheet metal boxes with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing.
2. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

B. Provide boxes in communication raceway systems at least every 100 feet and /or when 180 degrees in bends are exceeded when installing conduit on the interior of a building.

C. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, or when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated.

D. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system.

E. Boxes for telecommunications shall be minimum 4 11/16 inches square and 2 1/8 inches deep.

F. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

G. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces.

H. Backbox Supports

1. Backboxes installed in a sheet rock wall or ceiling shall be supported using the Caddy box mounting bracket or equivalent.
2. Support boxes installed flush in suspended ceilings tiles with T-bar bracket/bridge connected to ceiling grid.
3. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lock washers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces.
4. Boxes installed in a wall shall be flush with the wall upon completion.
5. Mounting Heights of Boxes
    a. Mount telecommunications outlets at height(s) as indicated on the Technology Drawings.

3.4 FLOORBOXES PO E THRU DEVICES

A. Coordinate insert requirements with Division 26 prior to Pre-Construction Submittal.

B. Indicate conduit stub-up location on pre-construction shop drawings and as-built drawings.

3.5 PULLBOXES UNCTION BOXES

A. Support sheet metal boxes directly from building structure or by bar hangers.

B. Boxes mounted overhead shall be no more than 5 feet above accessible (lay-in) ceiling.

C. Pullboxes for concealed conduits routed above inaccessible ceiling shall be accessible via an access panel. Confirm acceptable location in writing with Architect/Design Consultant prior to installation. Review reflected ceiling plans prior to Bid and include associated costs for additional access panels for required pullboxes for communications conduit with Bid.

1. Access panels shall be 30” by 30”; color, style, manufacturer as approved by Architect.

D. Size pullboxes per the following table:

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
1"	4"	4"	2-1/8"	Not applicable
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

E. Transition Point Enclosure

1. Where conduit for slab-on-grade floorboxes is not routed underground to serving Communications Rooms – and instead stubs up into accessible ceiling space - a transition point enclosure is required.
2. Transition Point Enclosure requirements:

a. 24” x 12” x 12” (minimum size) NEMA 1 enclosure with 1RU, 2RU, or 3RU wall bracket (Chatsworth 11583-719, Middle Atlantic VPM-2, or equal).
b. Enclosure shall be located above accessible (lay-in) ceiling.
c. Conduit from floorbox shall stub directly into enclosure.
d. Provide knockout bushings for number of 1” knockouts to support number of cables installed.
e. Each Transition Point Enclosure can support multiple floorboxes, up to 20 total Category cables.

3.6 SURFACE RACE AYS AND BOXES

A. Surface Raceways and Boxes are not allowed, except where specifically identified on the Drawings.

B. Where surface raceway meets the ceiling, provide “boot” accessory.

C. Attach back part of surface raceway to wall every 4 feet or less with screw or other appropriate form of permanent installation. Use of adhesive to mount raceway to the wall is prohibited.

3. IRE-MESH CABLE TRAY

A. Coordinate with all other disciplines to ensure cable tray routing and installation is coordinated with other systems.

B. Coordination with all other disciplines to ensure the 12-inch clearance above the tray is maintained.

C. Any elevation changes shall have radius drops installed to support the cables properly.

D. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Utilize 45-degree off-sets/routing to change elevation and horizontal routing.

E. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

F. Where cable trays encounter a non-fire-, smoke-, or acoustically-rated wall, cut opening through wall to facilitate continuous cable tray installation through wall.

G. Where cable trays encounter fire, smoke, or acoustically-rated wall, stop cable tray and provide Fire-or Smoke-Rated Pathway Devices. Provide number of devices to match square-inch capacity of cable tray. Devices shall be ganged together with manufacturer-specific accessory.

H. Where cable trays encounter more than 10 feet of inaccessible (gypsum board) ceiling, stop cable tray and provided number of 4” conduits over inaccessible ceiling to match square-inch capacity of cable tray, per the following table:

C□□□□ T□□□ S□□□	**Quantity of 4” Conduits**
2”x8”	2
2”x12”	3
4”x12”, 2”x24”	4
4”x18”, 6”x12”	5
4”x24”, 6”x18”	7
6”x24”	10

I. Ground and bond cable tray in accordance with NFPA 70, TIA-607, and NECA/BICSI-607.

1. Bond cable tray to the Telecom Ground Bar in each Communications Rooms. Utilize 6 AWG conductor for lengths up 13 feet, a 4 AWG conductor for lengths of 14 to 20 feet, and a 3 AWG conductor for lengths of 21 to 26 feet. Refer to TIA 607 standard for conductor size requirements for lengths longer than 26 feet.
2. Provide ground lugs between each section of cable tray to ensure electrical continuity of cable tray installation. Where cable tray sections are separated by conduit or firestopping sleeves, provide 6 AWG bonding jumper between cable tray sections.

J. Cable Tray Supports

1. Cable tray shall be supported by a trapeze or wall support brackets. No center support brackets shall be allowed.
2. A minimum of 3/8-inch all-thread shall be used for trapeze supports.
3. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals.
4. Cable tray shall be no less than 3-inches above a lay-in ceiling.
5. Cable tray shall be rigidly supported and level.
6. All-thread shall be covered from the attachment to the trapeze system to 3-inches above the tray to protect the cables from being chaffed.
7. All supports shall attach to structure or a rigid surface such as a plywood backer in a sheet rock wall.
8. Supports shall not be shared with any other discipline.

3. FIRESTOPPING

A. Fire-Rated Pathway Devices

1. Provide Fire-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a fire-rated wall. Quantity and size of devices shall be sized per manufacturer’s published cable fill counts, leaving 25% spare capacity.
2. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.
3. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.
4. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

B. Firestopping for Conduits

1. Provide firestopping components as part of a UL System for all conduit penetrations through fire-rated and smoke-rated walls and floors.
2. Coordinate locations and UL System with other Division 27 Subcontractors and indicate locations and UL System number on Pre-Construction Shop Drawings.
3. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

C. Firestopping for Backboxes

1. Provide firestopping component(s) as part of a UL tested/approved solution for backboxes located in fire-rated and smoke-rated walls.
2. Coordinate locations with other Division 27 Subcontractors and indicate locations on Pre-Construction Shop Drawings.

D. Smoke-Rated / Acoustical Pathway Device

1. Provide Smoke-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a smoke-rated wall or through a wall of a Noise Critical Room.
2. Quantity and size of devices shall be sized per manufacturer's published cable fill counts, leaving 25% spare capacity.
3. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.
4. For smoke-rated partitions: Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

E. Fire-rated Conduit (Circuit Integrity) Wrap

1. Provide Fire-rated Conduit (Circuit Integrity) Wrap for certain Communications conduits for the following systems:

   a. Section 275129 Two-Way Communications System
   b. Section 275319 Emergency Responder Radio Coverage (ERRC) DAS

2. Coordinate conduit size and lengths requiring wrap with Subcontractors of those sections prior to Bid and include cost to provide that wrap in the Bid.

3.9 LABELING

A. Wherever communications conduits stub up into Communications Room, either through the floor or wall), provide label on bottom/front half of conduit indicating communications system and far end location. Example: DATA FROM FRONT DESK FLOORBOX. At far end of these conduits, provide label indicating communications system and room name and room number. Example: DATA TO MDF 123.

B. Wherever communications conduits are installed overhead due to runs over inaccessible ceilings, provide label on bottom half of conduit at each end of the conduit indicated communications system and far end location. Example: HORI ONTAL CABLE TO LOBBY 251.

C. Provide label on cover of each pullbox / junction box identifying communications system cabling and destinations. Example: BACKBONE CABLE FROM MDF 123 TO IDF 456.

3.1 FUNCTIONAL AND PERFORMANCE TESTING

A. Refer to Section 27 00 10 for general Functional and Performance Testing requirements.

B. The following additional testing requirements shall be provided:

1. Cable Tray Two-Point Ground/Continuity Testing

   a. Prior to the two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the Contract Documents and in compliance with the TIA-607 Standard.
   b. All testing shall be conducted prior to any active equipment being installed.
   c. The Contractor shall use an earth ground resistance tester that is configured for a continuity test. This is also known as a two-point tester or a "dead earth" test.
   d. Prior to the two-point continuity test conduct a voltage test to ensure there is no stray voltage in the system.
   e. The testing shall include but is not limited to the following points.

      1) Cable tray to electrical ground in ER/TR.
      2) Cable tray to the building steel (if present).
      3) Cable tray to each SBB/TGB.

   f. Per the TIA-607, the maximum value for resistance between any point in the telecommunications bonding and grounding system and the building's electrical

grounding electrode system is 100 milliohms. In the case of long conductor runs, the resistance of the conductor must be factored into the total resistance. For example 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms. (0.06180 ohms per 1000 ft.)

3.11 FIELD OBSERVATIONS

A. Refer to Section 27 00 10 for Field Observation requirements.

3.12 DEMONSTRATION TRAINING AND AD USTMENTS

A. Refer to Section 27 00 10 for general Demonstration, Training, and Adjustment requirements.

B. Provide the following additional requirements:

1. Conduct (1) 1-hour site walk with Owner after pathways have been installed but prior to installation of suspended ceiling; point out pathway and pull box locations.

3.13 MAINTENANCE

A. Refer to Section 27 00 10 for Warranty Service and One Year Warranty Check requirements.

END OF SECTION

SECTION 27 05 34 - PATHWAYS AND INFRASTRUCTURE FOR AV SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section describes and specifies infrastructure devices associated with Div. 274115 Performance Audio-Visual Systems and Equipment:

1.2 DESCRIPTION OF THE WORK

A. Conduit pathways

B. Backboxes, Junction Boxes, and Pull Boxes

C. AV floor boxes

D. Cable support devices

1.3 SCOPE OF THE WORK

A. All Audiovisual Infrastructure devices listed in this Section shall be provided and installed by the Division 26 Electrical Contractor.

B. Conduit and containment pathways and terminations: Refer to associated AV-series Audiovisual Infrastructure drawings for conduit pathway scope, notes, and requirements.

C. All enclosures, as listed in the Audiovisual Device Legend sheets in the associated Audiovisual Infrastructure drawing packages, shall be furnished and installed by the Division 26 Electrical Contractor:
   1. Specialty enclosures and / or Custom enclosure configurations are listed in this Specification Section.
   2. Common enclosures and junction boxes are explicitly called out on Audiovisual Device Legend drawing sheet and are not restated here.

D. Audio-Visual Systems to be supplied under separate Section (27 41 15 Performance Audio-Visual Systems and Equipment).

1.4 RELATED DOCUMENTS

A. The general provisions of the contract, including General Provisions, Supplemental Conditions, and Division 1 – General Requirements, apply to the work specified in this section.

B. Refer to the associated AV-series Audiovisual Infrastructure drawings for additional information, notes, and exact locations pertaining to Infrastructure devices associated with Audiovisual Systems.

1.5 RELATED SECTIONS

A. Refer to Division 26 Electrical Drawings and Audiovisual AV-series drawings related to Division 26 electrical for coordination of conduits, pull wires, and connections to electrical power. All conduits, junction boxes, floor boxes and power are by Division 26. Refer to Electrical drawings for all power, and all pathways associated with such power, for Audiovisual systems.

B. All conduits, junction boxes, and floor boxes associated with Audiovisual System devices

shall be provided and installed by the Division 26 Electrical Contractor. Refer to AV-Series Audiovisual drawing sheets for all pathway requirements.

1.6 SUBSTITUTIONS

A. Refer to Division 1 for specific substitution procedures and submittal requirements.

B. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted, without a written request from the Installer and the written consent of the Consultant and the Owner.

C. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the Consultant.

D. Requests for substitution, when forwarded by the Installer to the Consultant and Owner, are understood to mean that the Installer represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified, that the same guarantee will be provided for the substitution as for the specified product, and that the Installer will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

E. Substitutions will not be considered if they are indicated or implied in Shop Drawing submissions without previous formal request, or, for their implementation, they require a substantial revision of the Contract Documents in order to accommodate their use.

F. Space allocations and utility rough-ins have been designed on the basis of equipment items named by manufacturer and model number. If any equipment not so named is offered which differs substantially in dimension or configuration from the named equipment, provide scaled shop drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project. The Installer shall coordinate final utility rough-in locations with actual equipment furnished.

G. Where substitute equipment requiring different arrangement or connections from those shown in the drawings is accepted by the Consultant, install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, making all necessary incidental changes without increasing the Contract amount. Pay all additional costs incurred by adjoining or connecting trades.

H. All requests for substitutions shall be submitted 2 weeks prior to the bid opening date. Substitutions shall be requested and approved in writing only, based upon these criteria.

1.7 COOPERATION AND COORDINATION

A. Cooperate and coordinate as required with the other contractors who are responsible for work not included in this section.

B. Provide any and all information as required or requested by the Owner, Architect/Engineer, Consultant, or General Contractor in order for this work to be completed to the satisfaction of the Owner, and in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases. All written correspondence shall be copied to the Consultant.

1.8 GUARANTEE AND WARRANTY

A. Guarantee all parts, labor, and workmanship furnished under this contract for a period of twelve months from the date of substantial completion.

B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 48 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

C. Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.

1.9 SUBMITTALS

A. Equipment lists, data sheets, etc. shall be 8-½” x 11" size, properly bound into a single or multiple volumes as necessary, and also submitted in electronic PDF format. Submit quantity in accordance with Division 1, General Requirements.

B. Within 45 days after the notice to proceed, submit to the Architect/Engineer identical copies of the following for approval:
   1. A complete equipment list, with manufacturers' names, model numbers, and quantities of each item;
   2. Manufacturers' data sheets on all equipment items;
   3. Floor plans and reflected ceiling plans, prepared at a scale not less than 1/8” = 1’-0”, showing device locations and orientation for all items in scope;
   4. Riser diagrams showing conduit requirements, to include all pull boxes and outlet boxes;
   5. Proposed construction details for all devices in this Specification Section. These details shall show dimensions, materials, finishes and color selection;

1.10 JOB CONDITIONS

A. Coordinate installation of mounts, back-boxes, floor boxes and all other devices specified in this Section with work of other trades.

PART 2 PRODUCTS

2.1 GENERAL

A. All items shall be new and unused. The following articles specifically list the acceptable items for this project. Where quantities are not noted, they may be obtained from the associated drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

2.2 FLOOR BOXES

A. Furnish and install recessed floor boxes, as identified, at the locations indicated in the drawings.

B. Provide floor box enclosures and construction covers, as applicable, to Division 26 for installation at each location.

C. Provide manufacturer’s pour pans, as/if required by mounting location, for each floor box.

D. Boxes shall have a voltage divider or gang box knockout to allow for power receptacles and low-voltage AV connections to reside within the same box, where required. Conduits for high and low voltages must enter box on appropriate side of voltage divider to maintain separation. High and low-voltage wires may not cross within the box.

E. Provide lid / bezel type in accordance with scheduled finished floor type at each location. Finished installation shall provide for all lids flush with associated scheduled floor type. Verify lid types with Architect prior to shop drawings submittal.

F. Verify factory color / finish options for all floor box lid/bezel assemblies with Architect prior to shop drawings submittal. If directed by Architect, paint to match Architect's color sample.

G. Floor box insert connector plates to be provided and installed by Div. 27 41 15. Where insert plate(s) incorporate power receptacle(s), power shall be terminated by Div. 26.

H. Furnish and install the following, or approved equal:
1. Type "FB1": FSR Inc FL-500P-6-B 6-inch depth floor box with FL-500P-SLD-BLK-C Lid Assembly. The Installer shall verify enclosure and lid model variants with scheduled finished floor type, site conditions, and the Architect prior to product acquisition and use appropriate version for each location. (Qty: as shown)

2.3 CABLE SUPPORT DEVICES

A. Furnish and install cable support devices for use with routing Audiovisual cabling at Audiovisual equipment and production locations as shown.

B. Secure to wall and/or ceiling structure with appropriate hardware and fasteners, as required by wall and/or ceiling type.

C. Coordinate with other trades, as required, to eliminate interference and obstructions with other devices.

D. Coordinate penetrations at walls and partitions, as required. Provide fire-stop intumescent bags or other local / superseding code-approved fire-stop mechanisms at all required penetrations. Multiple fire-stop system shall be employed, as required, to equal the full capacity of the cable tray.

E. Furnish and install the following:
1. Ladder Rack: Hoffman LSS-12BLK, or approved equal, 1'-0" ladder rack system. Provide support brackets and all manufacturer-required hardware and accessories. (Qty: as required to support pathways shown)

PART 3 EXECUTION

3.1 INSPECTION

A. Installer must examine substrates and conditions under which floor and wall mounted hardware and equipment enclosures are to be installed and notify the Consultant and Architect in writing of conditions detrimental to proper and timely completion of work.

3.2 INSTALLATION

A. Install the cable management trays, floor boxes, specialty enclosures and display wall boxes at the locations shown and in accordance with manufacturer's instructions. Install all devices level, plumb, secure and at the proper height. Cooperate with other trades to secure units to finished wall and floor surfaces. Repair and replace damaged items as directed by the Architect.

B. Coordinate layout of conduits, including specific routing and mounting elevations, with building structure and work of other trades.

C. Avoid crossing building expansion joints, to the extent possible. Where crossings occur, use expansion joints.

D. Provide a pull string in all raceways, cable trays, and conduits. Provide high tensile-strength pull lines in all conduits 4” and larger.

E. Installation of wall boxes back-to-back in opposite sides of a wall shall not be allowed. Allow a minimum of 2’-0” between boxes. At stud walls, provide a minimum separation of 1 stud cavity.

F. Provide protection for installed components so that all will be in perfect operating condition, without damage at completion of the project.

3.3 ADJUSTMENT AND CLEANING

A. Clean exposed surfaces of installed products.

B. Clean up all debris caused by work of this Section, keeping the premises neat and clean at all times.

END OF SECTION 27 05 34

SECTION 2 1 - STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 This section identifies the requirements, technical design, and specifications for the structured cabling system at the Fort Bend ISD George Bush High School, located in Richmond, Texas (“Owner”). The structured cabling system as specified is an Industry-Standard Category 6 and 6A structured cabling system and includes backbone cabling, horizontal cabling and equipment room hardware as specified.

1.2 The Contractor shall provide a Panduit Manufacturer’s 25-Year Performance Certification for the installed structured cabling system.

1.3 Contractor shall have PANDUIT GOLD level certification at time of the BID/PROPOSAL

1.4 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional structured cabling system regardless of any items not listed or described in this specification or associated drawings.

1.5 REQUIREMENTS TABLE OF CONTENT

1.6 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27 and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall be a **P**□□□□□□**G**□□□ **C**□□□□□□□□ prior to submitting a bid for the work.

2. The Contractor shall possess all relevant Manufacturer Certifications (i.e. structured cable systems, testing equipment, etc.,) for both the company and individual technicians and full time employees of the company, prior to submitting a bid for the work.

3. The Contractor’s Project Manager shall be a Registered Communications Distribution Designer (RCDD), full-time employee of the company and at all onsite coordination meetings. Subcontracting of RCDD certification is NOT ALLOWED

4. The Contractor shall have a minimum of (2) certified BICSI and Panduit Installers, full-time employees of the company and on onsite at all times. Subcontracting of BICSI Technicians is NOT ALLOWED

5. RCDD and BICSI Certified Technicians will be present at the following meeting:

a. Low Voltage Preinstallation Meeting

b. Cabling System Pathway Mockup

c. Owner walks / System inspections

d. Coordination Meetings

e. And Other events as requested by the Owner

6. The Contractor shall have been in business for a minimum of five (5) years.

7. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

8. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

C. Before the installation and rough-in of conduits for technology and audiovisual outlets in the typical classroom the Contractor shall mock up one classroom and one lab with respect to power, data, and audiovisual backboxes rough-ins for approval by the OAC team.

D. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1. SUBMITTAL REQUIREMENTS

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.

2. Contractor shall ensure submittals are submitted in a timely manner to ensure all products can be ordered and received on site in order to not cause any delays. If there are any concerns with any products having long lead times, those products shall be clearly identified in writing so the review and approval can be expedited.

3. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e., product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

4. Manufacturer product data sheets for each proposed system component.

   a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified will not be approved.

5. Manufacturer Product Certifications for Company.

6. Manufacturer Product Certifications for Installers.

7. Manufacturer Certifications for testing equipment technicians.

8. Manufacturer Certifications for testing equipment calibration.

9. RCDD Certificate for Contractor's Project Manager, full-time employee of the company and at all onsite coordination meetings.

10. BICSI and Panduit Certificate for Contractor's (2) Onsite Installers, full-time employees of the company and on onsite at all times

11. Manufacturer Warranty letter.

12. Documentation indicating that Contractor has been in business for (5) years.

13. Address of Contractor's local office within a 75-mile radius of the project site.

14. Quantity of full-time local technicians within a 75-mile radius of the project site.

15. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

16. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Design Consultant prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Design Consultant which certifies performance characteristics and compliance with ANSI/TIA/EIA 568-C standards.

J. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect/Design Consultant prior to submitting a proposal for this work. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the job as required.

2.2 ACCEPTABLE MANUFACTURERS

A. Fiber Optic Backbone Cable

1. Indoor (Plenum)

a. 50um OM3 012 Fiber indoor Armored Cable, Plenum

1) Panduit Part Number – FOPPX12Y

2) Corning Equivalent

B. Copper Backbone Cable

1. Indoor (Blue Sheath)

a. (3) Category 5e 24 AWG Unshielded Twisted Pair (UTP) Plenum

1) Panduit TX6000 Part Number – PUP5C04BU-F

2) General GenSPEED 6 Part Number – 5131278E

3) Commscope Part Number 2061F BL 4/24 W1000

4) Belden Cable Part Number 1585A D151000

C. Horizontal Cable

1. Category 6 UTP Plenum

a. Network Access (Blue Sheath)

1) Panduit TX6000 Part Number – PUP6004BU-UY

2) General GenSPEED 6 Part Number – 7131900

3) Commscope Part Number CS37P BLU

4) Belden Cable Part Number 4813 D15A1000

2. Wireless Access Points (Green Sheath) Cat 6A

1) Panduit TX6A Part Number – PUP6XHD04GR-G

2) General GenSPEED 10 MTP Gen 5 Part Number – 7151853

3) Commscope Part Number 2091B GRN

4) Belden Cable 10GXW13 0051000

b. IP Security Camera (Orange Sheath)

1) Panduit TX6000 Part Number – PUP6004OR-UY

2) General GenSPEED 6 Part Number – 7131905

3) Commscope Part Number CS37P ORG

4) Belden Cable Part Number 4813 003A1001 (minimum 5,000’ order)

3. Category 6 UTP Flooded

a. Indoor/Outdoor Copper Cable, category 6, UTP, 4-pair, 24 AWG, black (Black Sheath)

1) CommScope Part Number – CS34P-IO

2) Belden Cable Part Number – 2146A

D. Fiber Optic Cable Termination

1. 2RU Fiber Enclosure

a. Panduit 2RU Rack Mounted Fiber Optic Enclosure – Part Number FRME2U

b. Corning Equivalent

2. 50□m Multi-Mode Fiber Adapter Plate

a. Panduit 50um Multimode 10Gig OM3/4, LC,12 fibers, irconia Ceramic Sleeve Aqua

1) Panduit - Part Number – FAP6WAQDLC

2) Corning Equivalent

3. Fiber Blank Plate

a. Panduit Blank Metal Adapter Plate – Part Number FAPB

b. Corning Equivalent

4. 50□m Multi-Mode pig-tail LC Connectors

a. Panduit OM3, 1 fiber, 900□m buffered fiber, LC to pigtail multimode simplex pigtail – Part Number – FX1BN1NNNSNM001

b. Corning Equivalent

5. Loose Tube Fiber Fan-Out Kit

a. Panduit 36" Fiber Optic Fan-Out Kit, 12-fiber – Part Number – FO12CB

b. Corning Equivalent

6. Fiber Optic Slice Module

a. Panduit – FOSMF

b. Corning Equivalent

7. Fiber Optic Fusion Splice Sleeves

E. Copper Cable Termination

1. Building Entrance Terminals

1) Category 6 / 6A POE Rated Lightning Protection

a) Field End

(1) DITEK Part Number – DTK-MRJPOES

(2) DITEK CAT 6A POE Part Number – DTK-MRJETHS

b) Equipment Room/Telecommunications Room End

(1) Rack Mount Face Plate up to 12 Ports – DITEK Part Number – DTK-VM12RM

(i) Hinged Wall Mount Bracket 2RU – WBH2

(ii) Panduit Rack Cabling Manager - Part Number – NMF1

(iii) DITEK Versa-Module Power Over Ethernet Surge Protector-DTK-VM45POE

(iv) DITEK Versa-Module Plug – DTK-RM12FPPLUG for unused ports on the patch panel

(2) Wall Mount Face Plate up to 6 Ports – DITEK Part Number – DTK-VM6WM

(i) DITEK Versa-Module Power Over Ethernet Surge Protector- DTK-VM45POE

(ii) DITEK Versa-Module Plug – DTK-RM12FPPLUG for unused ports on the patch panel

(3) DITEK CAT 6 POE – DITEK Part Number – DTK-MRJPOEM

(4) 10 Gigabit Category 6A PoE Surge Protector – DTK-110RJC6APOE

(5) DITEK CAT 6A POE Part Number – DTK-MRJETHS

c) Contractor shall place WBH2 and DITEK's Equipment on the wall behind rack of WAPs and security camera patch panels.

d) Contractor shall terminate all osp, and indoor/outdoor cat6 / 6A cables for exterior security cameras and wireless access point to the DITEK's appropriate equipment.

Contractor shall coordinate with FBISD IT Department for the installation of the cables from DITEK's appropriate equipment to the owner's network switch.

2. Backbone Cable Termination Panels

a. Rack Mounted Voice Patch Panels

1) Panduit Cat 5e 1RU 24-Port angled patch panel– Part Number DPA245E88TGY

a) Two IDF's per 24 port patch panel, terminate 1 pair per port.

Example: (1) 24 port patch panel: IDF 1 ports 1-12, IDF 2 ports 13-24

b. Strain Relief Bar

1) Panduit Strain relief bar extends 5 inches off the rack to support and manage cables Part Number - SRB19D5BL

c. Termination Block Kit Components

1) Panduit 5e 110-Style Wall-Mount Wiring Block Kit w/ Legs, 100-Pair – Part Number – P110KB1004Y

d. Jumper Trough with Legs

1) Part Number - P110JTW-X

3. Horizontal Cable Termination Panels

a. Rack Mounted Data Patch Panels

1) Category 6 2RU 48-Port Unloaded Angled Patch Panels Part – Number CPPA48FMWBLY

2) Category 6A 2RU 48-Port Unloaded Angled Patch Panels Part – Number CPPA48FMWBLY

b. Strain Relief Bar

1) Panduit Strain relief bar extends 5 inches off the rack to support and manage cables Part Number - SRB19D5BL

c. Blank Inserts (Black)

1) Panduit Mini-Com Blank Module for unused ports – Part Number – CMBBL-X

4. Category 6/6A Modular Jacks

a. Network Access

1) Equipment Room/Telecommunications Room End (Blue)

a) Panduit Mini-com TX6 Plus UTP Jack Modules Part No. CJ688TGBU

2) Field End (Blue)

a) Panduit Mini-Com TX6 Plus UTP Jack Modules Part No. CJ688TGBU

b. Wireless Access Points (Cat 6A)

1) Equipment Room/Telecommunications Room End (Green)

a) Panduit Mini-Com Cat 6A UTP Jack Modules Part No. CJ6X88TGGR

2) Field End (Green)

a) Panduit Mini-Com Cat 6A UTP Jack Modules Part No. CJ6X88TGGR

c. IP Security Camera

1) Equipment Room/Telecommunications Room End (Orange)

a) Panduit Mini-Com TX6 Plus UTP Jack Modules Part No. CJ688TGOR

2) Field End (Orange)

a) Panduit Mini-Com TX6 Plus UTP Jack Modules Part No. CJ688TGOR

d. Wet Areas

1) Field End

a) Category 6, RJ45, black industrial bulkhead connector with protective cover Part Number - IAEBH6

5. Telecommunications Faceplates with Designation Window

a. 6-Port Single Gang Flush

1) Panduit Mini-Com Stainless Steel Faceplates with Labels Part No. CFPL6SY

2) Panduit Mini-Com Executive Series Single Gang Faceplates with Labels Part No. CFPE6WHY

Contractor shall coordinate with owner/architect prior to purchase of

Panduit faceplates.

b) 4-Port Single Gang Flush

1) Panduit Mini-Com Stainless Steel Faceplates with Labels Part No. CFPL4SY

2) Panduit Mini-Com Executive Series Single Gang Faceplates with Labels Part No. CFPE4WHY

Contractor shall coordinate with owner/architect prior to purchase of Panduit faceplates.

c) Wall Phone Single Gang Plate

1) Panduit Stainless steel phone plate with Giga-TX ™ Style Category 6 Keystone Jack Module. Part Number KWP6PY

2. 2-Port Surface Mount Box (White)

a) Panduit Mini-Com Surface Mount Box Part No. CBX2WH-A

3. 4-Port Surface Mount Box (White)

a) Panduit Mini-Com Surface Mount Box Part No. CBX4WH-A

4. Blank Insert (White)

a) Panduit Mini-Com Blank Module – Part No. CMBWH-X

5. QuickPort In-Ceiling Bracket with Drop Ceiling Clip

a) Leviton - QuickPort In-Ceiling Bracket – Part No. 49223-CBC

F. Equipment Racks, Cabinets, Cable Management, and Accessories

1. Two-Post Rack - 19” x 84” Open Frame (Black)

a) Panduit – Part Number R2P

2. Vertical Cable Managers (Black)

a) Panduit 10” Double Sided Vertical Cabling Section - Part Number – PR2VSD10

3. Horizontal Cable Managers (Black)

a) Panduit Rack Cabling Manager - Part Number - NMF2

4. Vertical Power Strip for 7’ Equipment Rack with standoff brackets

a) Tripp-Lite Vertical Power Strip with Meter and– Part Number PDUMV30HVNETLX

b) Panduit Vertical PDU Mounting Bracket – Part Number R2PPDUB

Vertical power strip and standoff bracket shall not interfere with the network switches.

G. Cable Runway (Ladder Type)

1. Universal Cable Runway

a) 12-inch Chatsworth - Part Number 10250-712

2. Cable Runway Radius Drop, Cross Member

b) 12-inch Chatsworth - Part Number 12100-712

3. Cable Runway Radius Drop, Stringer

a) Chatsworth - Part Number 12101-711

4. Cable Runway Butt-Splice Kit

a) Chatsworth - Part Number 11301-701

5. Cable Runway Junction-Splice Kit

a) Chatsworth - Part Number 11302-701

6. Rack-to-Runway Mounting Kit

a) 9 to 12-inch runway Chatsworth - Part Number 10595-712

7. Cable Runway Elevation Kit for Racks/Cabinets

a) Chatsworth - Part Number 10506-706

8. Triangular Support Bracket, Aluminum

a) 6 to 12-inch runway Chatsworth - Part Number 11312-712

9. Wall Angle Support Kit, Cable Runway

a) 12-inch runway Chatsworth - Part Number 11421-712

10. 90 Degree Runway-Splice Kit

a) Chatsworth - Part Number 11314-701

11. 45 Degree Runway-Splice Kit

a) Chatsworth - Part Number 11313-701

12. Foot Kit, Cable Runway

a) Chatsworth - Part Number 11309-701

13. Vertical Wall Brackets (pair)

a) Chatsworth - Part Number 10608-701

14. Threaded Ceiling Kit, Cable Runway

a) Chatsworth - Part Number 11310-001

15. Threaded Rod Cover

a) Chatsworth - Part Number 11085-001

16. Protective End Caps for Cable Runway

a) Chatsworth - Part Number 10642-001

17. End Closing Kit, Cable Runway

a) Chatsworth - Part Number 11700-712

H. Pathway Cable Support
1. Panduit J-Mod Cable Support System

2. Erico – CADDY CAT LINKS J-Hook Series
3. Wyr-Grid – WG12BL10 (minimum)

a. Contractor to shall use associated transitions, hardware to provide solid support and grounding (sized appropriately according to manufacture specifications) to be used outside the MDF/IDF and a minimum of 20’ in any direction cabling trunks leave MDF/IDF. The 20' requirement is for cable tray not j-hooks.

b. Wire basket tray shall have a 6” clearance from ceiling tile to the bottom of basket tray and 12” clearance from the top of the basket tray to HVAC Units, HVAC duct, heating ducts, and heating equipment, etc.

c. Wire basket tray shall have a 12” clearance from the side of basket tray to HVAC Units, HVAC duct, heating ducts, and heating equipment, etc.

d. Wire basket tray shall be properly grounded and bonded as per industry standards.

I. Grounding and Bonding

1. IDF Grounding Bus Bar, 12”

a) Panduit Part Number - GB4B0612TPI-1

b) Chatsworth - Part Number 13622-012

2. Grounding strip

a) Panduit Part Number - RGS134-1Y

3. Equipment Bonding Jumper

a) Panduit Part Number - GJS6xxU (GJS660U)

xx – denotes length

4. Cable Runway Ground Strap Kit

a) Chatsworth - Part Number 40164-001

5. Compression Lugs

a) Panduit - Part Number - LCC6-14JAWH-L

6. 6 AWG Solid Green Insulation Ground Wire

a) Superior Essex - Part Number 12-018-04

7. 3/0 Stranded Green Insulation Ground Wire

8. Cable Sheath Bonding Clamp

J. Labeling

1. Permanent Labels for Fiber Optic Cables

a) Laser/Ink Jet Self Laminating Labels

1) Panduit Part Number Series – S100X

2. Permanent Labels for Copper Cables
    a) Laser/Ink Jet Self Laminating Labels
        1) Panduit Part Number Series – S100X
3. Permanent Labels for Backbone Fiber Optic Cables
    a) Self-Laminating Fiber Optic Cable Marker Tags
        1) Panduit Part Number – PST-FO
4. Permanent Labels for Innerduct
    a) Self-Laminating Fiber Optic Cable Marker Tags
        1) Panduit Part Number – PST-FO

            To be used for Innerduct with fiber installed.
        2) Panduit Part Number – PST-FOBLNK

            To be used for empty spare Innerduct
5. Permanent Labels for Patch Panels and Ceiling Grid
    a) Panduit Component Label
6. Permanent Labels for Faceplates and Ceiling Grid
    a) Panduit Component Label
7. Permanent Labels for Grounding Cables a. Laser/Ink Jet Self Laminating Labels 1) Panduit Part Number Series – S100X

K. Fire Stop
1. STI Spec Seal Part Number
    a) MDF/IDF - E -Path 44 Series
    b) E -Path
2. SpecSeal Fire Stop Products (SSP)
    a) Sleeves - Series SSP Fire Stop Putty - Part Number – SSP100

L. Plywood
1. 8’ H x 4’ W x ¾” Sheets of BC grade fire-rated plywood

M. Fire Retardant Paint (White)
N. Fiber Patch Cables
1. Multi-Mode Fiber Patch Cords
    a) Panduit LC - LC MM Fiber Optic Patch Cords Part Number - FXE10-10M3Y
    b) Corning Equivalent

Contractor shall confirm with FBISD Technology Department on the lengths, colors and quantities prior to purchase. Quantity is minimum of one patch cable for every terminated strand of fiber.

O. Copper Patch Cables

1. Panduit TX6 Plus Category 6 /6A UTP Patch Cord – Part Number UTPSPxxzzY (cat 6) UTP28X (cat 6A)

xx – denotes length, zz denotes color other than off white

a) Panduit - Data/Voice (Blue) Part Number -UTPSPxxBUY

b) Panduit – Wireless Access Point (Green) Cat 6A Part Number -UTP28XxxGR

c) Commscope – Exterior Wireless Access Point (OSP) Cat 6A – Part Number – C015582

a. For Exterior Patch Cables, Contractor to provide the recommended length from terminated category cable to exterior equipment.

d) Panduit – Security Camera (Orange) Part Number -UTPSPxxORY

e) Commscope – Security Exterior Camera (OSP) Part Number – 26

a. For Exterior Patch Cables, Contractor to provide a recommended length from terminated category cable to exterior equipment.

f) Panduit – Kronos, HVAC, and DSX (Violet) Part Number -UTPSPxxVLY

Contractor shall confirm with FBISD Technology Department on the lengths, colors and quantities prior to purchase. Quantity is minimum of two patch cables for every terminated category cable.

PART 3 - EXECUTION

3.1 CODES STANDARDS REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire

2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition

2. Outside Plant Design Reference Manual 5th Edition

3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices

4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling

5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Electronics Industry Alliance (EIA)

F. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998

2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998

3. FCC Part 76, Cable Television Service, revised 1998

G. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable

2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors

3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

H. International Electrotechnical Commission (IEC)

I. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System

2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive

3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)

4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code

5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

J. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)

2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

3. ISO/IEC 14763-1, Information Technology-Implementatio, and Operation of Customer Premises Cabling-Administration, 1999

4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

5. ISO/IEC 14763-1, Information Technology-Implementation, and Operation of Customer Premises Cabling-Administration, 1999

K. National Cable Television Association (NCTA)

L. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code
2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
3. NFPA-101, Life Safety Code
4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)

O. Occupational Safety and Health Administration (OSHA)

P. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA -568.0-D.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
4. ANSI/TIA-568.3-D-1, Optical Fiber Cabling Components Standard.
5. ANSI/TIA–569-E Commercial Building Standard for Telecommunications Pathways and Spaces.
6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure.
7. ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
8. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

Q. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment, and Construction
2. RUS Bull 1751F-643 (2002) Underground Plant Design
3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)

6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)

7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)

8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

R. Underwriters Laboratories, Inc. (UL)

1. UL 510 (2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

2. UL 910 (NFPA 262 1990) Applicable Flame Test

3.2 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Design Consultant in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Design Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to design changes, equipment, materials and/or installation changes. In any event, Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Code, the more stringent shall take precedence.

3.3 GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Design Consultant for direction before proceeding with that part of the work.

B. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.

D. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

F. Contractor shall notify the Architect/Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

G. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner’s facilities for the disposal of excess or scrap materials.

H. Equipment and materials installed by the Contractor shall be free of defects and damage.

I. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

J. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

K. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Design Consultant.

L. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

M. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

N. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Design Consultant.

O. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

P. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

Q. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

R. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

S. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.4 SYSTEM REQUIREMENTS

A. Quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a complete and functioning system. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity shall be furnished.

B. Intra-Building Cable Plant

1. Fiber Optic Cable

a) 50 □m Multi-Mode

1) Contractor shall furnish and install plenum rated indoor/outdoor rated fiber optic cables in contractor-furnished and installed plenum rated innerduct.

2) Contractor shall install a 10-foot service loop using a U-Shape configuration mounted and stored on the wall above the ladder rack.

3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

4) The contractor shall furnish and install:

a) Plenum rated armored fiber optic cable from MDF to IDF as indicated on the technology drawings.

2. Fiber Optic Termination

a) Contractor shall terminate all installed fiber optic strands with connectors and place into fiber optic enclosures as indicated in the technology drawings.

b) Contractor shall furnish fiber optic enclosures and coupler panels for all fiber optic strands and blank panels for all unused slots.

c) The Contractor shall furnish and install:

1) Fiber enclosure(s) inside MDF as indicated on the technology drawings.

2) Fiber enclosure(s) inside IDF as indicated on the technology drawings.

3. Copper Cable

a) High Pair Count

1) The Contractor shall furnish and install plenum-rated copper cables.

2) The Contractor shall install a 10-foot service loop using a U-Shape configuration mounted at the ends of each cable, mounted, and stored on the wall above the ladder rack.

3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

4) The contractor shall furnish and install:

a) (3) Category 5e plenum rated cable(s) from MDF to IDF as indicated on the technology drawings.

4. High Pair Count Termination

a) Patch Panels

1) The Contractor shall furnish and install rack mounted voice patch panels.

a) Two IDF’s per 24 port patch panel, terminate 1 pair per port.

Example: (1) 24 port patch panel: IDF 1 ports 1-12, IDF 2 ports 13-24

2) The Contractor shall furnish and install:

a) 24-port voice angled patch panel(s) inside MDF as indicated on the technology drawings.

b) 24-port voice angled patch panel(s) inside IDF as indicated on the technology drawings.

C. Horizontal Cable

1. No horizontal cable shall be longer than two hundred ninety-five (295) feet. If any station cable will be longer than two hundred ninety-five (295) feet, Contractor shall stop installation of the cable and immediately notify Architect/Design Consultant in writing. If Contractor fails to notify the Architect/Design Consultant in writing, Contractor shall replace cable at no cost to the Owner.

2. The Contractor shall furnish and install horizontal cables within each Technology Region from the respective ER or TR to each outlet location as indicated in the technology drawings.

3. The Contractor shall install a 10-foot service loop using a U-Shape configuration mounted and stored above the ladder rack in each respective Equipment Room or Telecommunications Room.

4. The Contractor shall provide a 10-foot service loop coiled (using figure eight configuration) and supported directly above the workstation outlet.

5. The Contractor shall install wet rated cat 6 cable(s) at floor boxes, and poke thru conduit(s) that are under slab or in slab.

D. Horizontal Cable Termination

1. Contractor shall terminate cables as defined by the ANSI/TIA/EIA 568-D.2 Commercial Building Wiring Standard with the EIA-568B sequence.

2. Workstations

a) Contractor shall furnish and install modular jacks to terminate UTP horizontal cables.

b) Contractor shall furnish and install faceplates, systems furniture faceplates, or surface-mount boxes to house modular jacks as indicated in the technology drawings.

1) Any unused faceplate positions shall have the appropriate number and color of blanks installed.

3. Equipment Rooms / Telecommunications Rooms

a) Horizontal Cable for Data

1) Contractor shall furnish and install Panduit angled patch panels, blank inserts (for all unused slots), and horizontal cable managers to terminate horizontal data cables as indicated in the technology drawings.

2) The Contractor shall provide and install:

a) 48-port rack mounted Panduit angled patch panel(s) in IDF as indicated on the technology drawings.

b) Horizontal Cable for IP Security

1) Contractor shall furnish and install Panduit angled patch panels, blank inserts (for all unused slots), and horizontal cable managers to terminate horizontal IP security cables as indicated in the technology drawings.

2) The Contractor shall provide and install:

a) 48-port rack mounted Panduit angled patch panel(s) in IDF as indicated on the technology drawings.

c) Horizontal Cable for Wireless Access Points – Cat 6A

1) Contractor shall furnish and install Panduit angled patch panels, blank inserts (for all unused slots), and horizontal cable managers to terminate horizontal wireless access point cables as indicated in the technology drawings.

2) The Contractor shall furnish and install:

a) 48-port rack mounted Panduit angled patch panel(s) in IDF as indicated on the technology drawings.

4. Horizontal Cable requiring lightning protection

1) Contractor shall furnish and install lightning protection on both ends of any cables on the exterior of the building as indicated in the technology drawings.

2) All lightning protection shall be installed per manufacturer's instructions including but not limited to placement and bonding requirements.

3) The Contractor shall furnish and install:

a) DITEK's Equipment for MDF/IDFs

b) Contractor shall terminate all osp, and indoor/outdoor cat6 / 6A cables for exterior security cameras and wireless access point to the DITEK's appropriate equipment.

c) Contractor shall place DITEK's Equipment and associated hardware on the wall behind rack of WAPs and security camera patch panels.

d) Contractor shall coordinate with FBISD IT Department for the installation of the cables from DITEK's appropriate equipment to the owner's network switch.

E. Patch Cables (Snagless)

1. Fiber

a) Equipment Rooms / Telecommunications Room

1) The Contractor shall furnish and store (1) LC to LC fiber optic patch cable in the original manufacturer packaging plus 25 percent spare for each terminated strand. Patch cable length is determined as needed per MDF and IDF Room layout and shall be coordinated with FBISD Technology Department.
2) Contractor shall confirm with FBISD Technology Department on lengths and quantities prior to purchase.

2. Copper

a) Workstations

1) The Contractor shall furnish and store (1) Category 6 patch cable in original manufacturer packaging for each cable terminated plus 25 percent spare for each terminated cable.

a) Category 6 patch cables for each data/voice end user workstation outlet terminated shall be blue.

b) Category 6A patch cable for each wireless access outlet terminated shall be green.

c) Category 6A OSP patch cable for each exterior wireless access outlet terminated shall be OSP Rated

d) Category 6 patch cable for each IP camera outlet terminated shall be orange.

e) Category 6 OSP patch cable for each exterior IP camera outlet terminated shall be OSP Rated

f) Category 6 patch cable for each special system (HVAC, Kronos, and DSX) terminated shall be violet.

Contractor shall confirm with FBISD Technology Department on the lengths, colors and quantities prior to purchase.

b) Equipment Rooms / Telecommunications Rooms

1) The Contractor shall furnish and store (1) Category 6/6A patch cable in original manufacturer packaging for each cable terminated plus 25 percent spare for each terminated cable.

a) Category 6 patch cables for each data/voice end user workstation outlet terminated shall be blue.

b) Category 6A patch cable for each wireless access outlet terminated shall be green.

c) Category 6 patch cable for each IP camera outlet terminated shall be orange.

d) Category 6 patch cable for each special system (HVAC, Kronos, DSX) terminated shall be violet.

2) Patch cable length is determined as needed per MDF / IDFs layout and shall be coordinated with Fort Bend ISD Technology Department.

Contractor shall confirm with FBISD Technology Department the lengths, colors and quantities prior to purchase.

F. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.

2. Contractor to shall use associated transitons, hardware to provide solid support and grounding (sized appropriately according to manufacture specifications) to be used outside the MDF/IDF and a minimum of 20’ in any direction cabling trunks leave MDF/IDF. The 20' requirement is for cable tray not j-hooks.

3. Wire basket tray shall have a 6” clearance from ceiling tile to the bottom of basket tray and 12” clearance from the top of the basket tray to HVAC Units, HVAC duct, heating ducts, and heating equipment, etc.

4. Wire basket tray shall have a 12” clearance from the side of the basket tray to HVAC Units, HVAC duct, heating ducts, and heating equipment, etc.
5. Wire basket tray shall be properly grounded and bonded as per industry standards.
6. When cables leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks cable supports.
7. No cable pathway shall exceed 40% fill ratio.
8. The contractor shall furnish a separate j-hook cable support pathway for each cable type (backbone fiber, backbone, copper, data, wireless access point, and security). Provide 30% growth without exceeding the 40% fill rate.
9. J-hooks cable supports shall be installed no more than five-feet (5’) apart on center, using only manufacturer-approved installation methods and hardware.
10. J-hooks cable supports shall be installed no higher than 3-feet above the accessible ceiling to allow for ease of access for future moves, adds and changes
11. No grid wire shall be utilized for support only use solid supports (clips, all thread, anchors, etc.).
12. J-hooks shall be furnished with closure clips.
13. Maximum sag between supports shall not exceed twelve-inches (12”).
14. Contractor shall establish j-hook cable supports pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.
15. Cable Dressing
    a) No nylon cable ties shall be used at any time during the installation of the cable.
    b) Above Ceiling
        1) Contractor shall furnish and install plenum-rated hook loop straps in plenum-rated airspaces.
            a) The Contractor shall install no more than (1) hook loop strap between each j-hook or saddle strap or at service loop locations.
    c) Equipment Rooms / Telecommunications Rooms
        1) The Contractor shall bundle all visible cables with Contractor furnished and installed hook loop straps.
            a) Hook loop straps shall be installed twenty-four (24) inches apart on center.

G. Equipment Rooms / Telecommunications Room Build-Out

1. Plywood
    a) The Contractor shall furnish and install 8’ H x 4’ W x ¾” D sheets of BC grade fire-rated plywood as indicated in the technology drawings.

b) The Contractor shall mount all plywood vertically starting at 24” AFF.

c) The Contractor shall cover the plywood with two (2) coats of Contractor furnished white fire-retardant paint leaving exposed (1) fire rating stamp per sheet.

2. Cable Runway (Ladder Type)

a) Contractor shall furnish and install cable runway using manufacturer-approved hardware and installation methods as indicated in the technology drawings.

b) Contractor shall furnish and install vertical sections of cable runway using manufacturer-approved hardware and installation methods to provide transition and support where cables enter or exit the room using a vertical pathway.

c) Contractor shall furnish and install radius drops cross member and stringers above each rack using manufacturer-approved hardware and installation methods where cables exit the horizontal section of the ladder rack.

d) Contractor shall ground and bond each cable runway section to the next utilizing ground straps and ensure metal-to-metal contact.

3. Equipment Racks and Cabinets

a) Contractor shall furnish and install equipment racks with vertical management using manufacturer approved hardware and installation methods as indicated in the technology drawings.

b) Contractor shall secure relay racks to the concrete floor utilizing expandable concrete anchors.

c) Contractor shall secure the equipment racks to the cable runway using cable runway elevation kits and manufacturer approved hardware and installation methods.

d) Contractor shall bolt all equipment racks and vertical cable managers together.

e) Contractor shall individually ground and bond each equipment rack and ensure metal-to-metal contact.

f) Contractor shall furnish and install:

1) 19” x 84" equipment rack(s) in IDF as indicated on the technology drawings

H. Grounding and Bonding

1. General

a) The Contractor shall ensure metal-to-metal contact for all terminations.

b) All materials shall be UL Listed.

c) All connections shall be made with UL Listed compression 2-hole lugs.

d) Contractor shall use an anti-oxidation compound on all connections.

e) In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TMGB/PBB and TGB/SBB shall be bonded to the vertical steel metal frame using a minimum 6 AWG plenum rated green insulated conductor.

f) A Grounding Equalizer conductor shall be installed when required by ANSI/TIA/EIA-607-D (Interconnects multiple TBBs on the top floor and every 3rd floor in between).

g) The connection to building steel does not eliminate the requirement for the TBB or EBC to the service ground.

h) Grounding/Bonding conductors shall be labeled within (6) inches from their termination point with wrap around labels.

2. Telecommunications Main Grounding Busbar / Primary Bonding Busbar (TMGB/PBB)

a) Contractor shall furnish and install a TMGB/PBB in the Equipment Room/Main Telecommunication Room as indicated in the technology drawings.

b) TMGB/PBB shall be insulated from its support using an insulator that is listed for the purpose by a nationally recognized testing laboratory (NRTL).

c) Only one lug shall occupy a hole. No stacking lugs or “Double Lugging” shall be accepted.

3. Telecommunications Grounding Busbar / Secondary Bonding Busba (TGB/SBB)

a) Contractor shall furnish and install a TGB/SBB in each Telecommunications Room as indicated in the technology drawings.

b) TGB/SBB shall be insulated from its support using an insulator that is listed for the purpose by a nationally recognized testing laboratory (NRTL).

c) Only one lug shall occupy a hole. No stacking lugs or “Double Lugging” shall be accepted.

4. Telecommunications Bonding Backbone (TBB)

a) The Contractor shall furnish and install a TBB consisting of a minimum 6 AWG plenum rated green insulated copper conductor in a star topology between the TMGB/PBB and each TGB/SBB as indicated in the Technology drawings.

b) When exceeding (13), feet the TBB shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil.

c) Where the TRs are stacked the TBB shall be continuous to the uppermost TR. “T” taps shall be used to tie TGB/SBBs on floors between the TMGB/PBB and the uppermost TGB/SBB.

d) Conductor shall be sized from the TMGB/PBB to the uppermost TGB/SBB and each conductor between a “T” tap and the TGB/SBB shall be the same size as the TBB it is fed from.

5. Equipment Bonding Conductor (EBC)

a) Contractor shall furnish and install a minimum 6 AWG plenum rated green insulated conductor from the TMGB/PBB or TGB/SBB as applicable to each ladder rack system, equipment rack, cabinet, metallic raceway, lightning protector, or multi-pair cable with a metallic element. Contractor shall use an anti-oxidation compound on all connections.

b) When exceeding (13) feet the EBC shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil.

6. Bonding Conductor for Telecommunications (BCT)

   a) Contractor shall furnish and install a minimum 6 AWG plenum rated green insulated copper conductor from the TMGB/PBB to the main building electrical service ground as indicated in the Technology drawings.

   b) The installation of the BCT to the main building electrical ground shall be performed by a licensed Electrical Contractor.

   c) When exceeding (13) feet the BCT shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil

I. System Labeling

1. Contractor shall verify room numbers and confirm the final room numbering scheme prior to generating any labels.

2. Horizontal Cables shall be labeled within (1) inches from the termination point inside the Equipment Room/Telecommunications Rooms.

3. Horizontal Cables shall be labeled within (6) inches from the termination point at the workstation end.

4. Backbone Fiber and Copper Cables shall be labeled within (12) inches of the visible end of the jacket and at each pull point location. If passing through an IDF it will be labeled when entering and leaving that IDF.

5. Fiber Innerduct shall be labeled within (12) inches of the point of entry of the fiber optic enclosure and at each pull point location. If passing through an IDF it will be labeled when entering and leaving that IDF.

6. Bonding conductors shall be labeled within (6) inches from their termination point.

7. Cables shall be labeled identically at both ends.

8. Equipment Racks

   a) Equipment racks in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

      1) Labels shall be centered on the top front of the equipment rack.

9. Cabinets

   a) Cabinets in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

      1) Labels shall be centered on the top front of the Cabinet.

10. Fiber Optic Enclosures

    a) Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack.

    b) A label for each terminated strand shall be securely placed inside each fiber optic enclosure.

11. Backbone Cable

a) Fiber Optic Cable

1) Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, rack number, fiber strand numbers, and type (i.e., A1-R1-B1/001-012MM).

2) Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting building code, Equipment Room and/or Telecommunications Room, enclosure number, and strand number to and from respectively (i.e., A1/01/01-12 – B1/01/01-12).

b) High Pair Count Copper Cable

1) For high pair count copper backbone cables, the label scheme shall contain, cable origin room number, rack number, the cable destination room number, and cable pairs (i.e., A1-R1-B1/001-025).

12. Horizontal Cable

a) Inside Equipment Rooms

1) Horizontal cables shall be labeled at each end with the MDF/IDF room number, rack number, patch panel letter, and port number. (i.e., A1-R1-A01).

2) Patch panels in each closet shall be labeled sequentially starting with the first Patch Panel in the top of the first relay rack (A, B, C, D, E, etc.).

3) All patch panels will indicate the room number along with the patch panel port designation. The labels shall be mechanical labels that are neatly printed with uniform font and evenly spaced across the patch panel. Room numbers will be in sequential order throughout the panels as indicated on the drawings.

4) 110-type blocks shall contain the destination room number, pair numbers, and binder pair number under each pair termination. (example)

a) 110-type block labels shall be printed on product-specific label strips and placed into label holders.

13. Workstation Faceplates

a) Cables and wall plates shall be labeled denoting origin, Equipment Room/Telecommunications Room Number, Rack Number, Patch Panel, and Port Number. (i.e., B1-R1-A01).

14. TMGB/PBB and TGB/SBB

a) TMGB/PBB and TGB/SBB shall be labeled with a unique identifier (i.e., TMGB/PBB-D100T, TGB/SBB-B123T).

15. Bonding Conductors

a) The following conductors shall be labeled at each end with the destination end and origin room number (i.e., A1 – IDFB1).

1) Bonding Conductor for Telecommunications

2) Telecommunications Bonding Backbone

3) Grounding Equalizer

4) Equipment Rack

3.5 TESTING REQUIREMENTS

A. Fiber Optic Cable

1. Installed strands shall be tested and certified in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test bi-directionally end to end and certified in accordance with applicable industry standards and manufacturer certifications requirements with an OTDR field and Power Meter tester that is within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.

5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe cable testing.

6. The Architect/Design Consultant may randomly select 5% of the installed strands for test verification purposes. The Contractor shall re-test these strands in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed strands at no cost to the Owner.

B. Copper Backbone Cable

1. Installed pairs shall be tested and certified in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test and certify all copper pairs with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.

5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe cable testing.

6. The Architect/Design Consultant may randomly select 5% of the installed pairs for test verification purposes. The Contractor shall re-test these pairs in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed pairs at no cost to the Owner.

C. Category 6/6A UTP Cable

1. Cable links shall be tested in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test and certify the structured cable system with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. No, Fail or Pass results will be accepted.

5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe field testing.

6. The Architect/Design Consultant may randomly select 5% of the installed links for test verification purposes. The Contractor shall re-test these links in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed links at no cost to the Owner.

D. Grounding and Bonding

1. Main Building Ground

a) Coordinate with electrical contractor and provide a copy of their test results for the main building ground. The results shall be below 25 Ohms.

2. Two-Point Ground/Continuity Testing

a) Prior to the two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the drawings and specifications and in compliance with the TIA-607-D Standard.

b) All testing shall be conducted prior to any active equipment is installed.

c) The Contractor shall use an earth ground resistance tester that is configured for a continuity test. This is also known as a two-point tester or a “dead earth” test.

d) Prior to the two-point continuity test conduct a voltage test to ensure there is no stray voltage in the system.

e) The testing shall include but is not limited to the following points.

1) Building electrical grounding electrode and the TMGB/PBB.

2) TMGB/PBB, TGB/SBB to electrical ground in ER/TR.

3) TMGB/PBB, TGB/SBB to the building steel (if present).

4) TMGB/PBB to each TGB/SBB.

5) Building steel (if present) to the electrical ground.

6) TMGB/PBB, TGB/SBB to Equipment Racks

f) Per the TIA-607-D, the maximum value for resistance between any point in the telecommunications bonding and grounding system and the building’s electrical grounding electrode system is 100 milliohms. In the case of long TBB and Grounding Equalizer conductor runs, the resistance of the conductor must be factored into the

total resistance. For example, 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms. (0.06180 ohms per 1000 ft.)

g) The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe field testing.

3.6 PRO ECT CLOSEOUT DOCUMENTATION

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.

2. Three (3) sets of drawings depicting the condition of the structured cabling system as installed.

3. As-Built drawings shall be produced in AutoCAD 2013 or higher and provided in hardcopy and electronically in .dwg and PDF format. Provide (1) laminated copy ARCH C (18” X 24”) in each MDF/IDF.

4. Hardcopy drawings shall be provided in the original size as issued by the Architect/Design Consultant.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.

6. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all equipment room/telecommunication room layouts, wall elevations, equipment rack elevations, ladder racks, cable tray, sleeves, backbone, and horizontal cable pathways, workstation locations, and labeling scheme.

B. Test Documentation

1. Test documentation shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until these test results are received and approved by the Architect/Design Consultant.

2. Three (3) sets of test documentation for the structured cabling system as installed.

3. Test results shall be provided in hard copy and electronic format (i.e., manufacturer’s proprietary testing software along with applicable reader software) and PDF electronic format.

4. Test documentation shall be bound, sectioned, and tabbed in the following sequence as applicable:

a) Tester(s) Calibration Certificate(s)

b) Inter-Building Backbone Fiber Optic Cable

c) Intra-Building Backbone Fiber Optic Cable

d) Intra-Building Backbone Count Copper

e) Horizontal Category 5e Cable

f) Horizontal Category 6 Cable

g) Horizontal Category 6A Cable

h) Main Building Ground

i) Two-Point Ground/Continuity Test

C. Manufacturer's Performance Certification

1. Certificate shall be provided to the Architect/Design Consultant at the time of final system acceptance. Final payment will not be recommended until the certificate of certification is received and approved by the Architect/Design Consultant.

a) The manufacturer of the solution shall furnish a performance certification as per the specifications starting at final system acceptance.

b) One original and two copies of the Manufacturer's Certificate shall be provided.

D. Manufacturer's Product Warranty

1. Certificate of product warranty shall be provided to the Architect/Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect/Design Consultant.

a) The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.

b) One original and two copies of the Manufacturer's product warranty shall be provided.

E. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

a) Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor, and workmanship starting at final system acceptance.

b) One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e., Contractor name, Point of Contact, address, phone number, and email address) and start and end date for warranty call outs.

END OF SECTION

SECTION 27 41 15 - PERFORMANCE AUDIO-VISUAL SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Architectural, structural, mechanical, electrical, and other applicable documents and drawings are considered a part of the Performance Audio-Visual Systems and Equipment (hereafter referred to as AV Systems) documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF THE WORK

A. The following systems are considered part of this project. The complete AV System for each area is comprised of several independent subsystems, and includes, but is not limited to the following areas:
   1. Coordination of AV Systems needs with the electrical systems installation contractor as outlined in the Drawings and Specifications.
   2. Coordination of AV Systems needs with structural systems installation contractor as outlined in the Drawings and Specifications.
   3. Coordination of AV Systems needs with the technology/data systems installation contractor as outlined in the Drawings and Specifications.
   4. Coordination of AV Systems needs with all other trades, as required to successfully install systems functioning in accordance with the intent expressed in the Drawings and Specifications.
   5. Field-verify all conditions, dimensions, and routing. Fully comply with the Contract Documents, including, and without limitation, the need to check, confirm, and coordinate work with that of other disciplines.
   6. Remove existing Sound / AV system equipment, inventory, and turn over to the Owner. Coordinate with the Owner, Architect, and GC/CMaR for formal turnover procedures. Equipment to be removed consists of the following:
      a. Auditorium loudspeakers.
      b. Main amplifier/processing racks and associated equipment.
      c. Control booth mixing console, auxiliary equipment, and wireless microphone systems.
      d. All connector plates associated with existing audiovisual systems. At existing infrastructure locations being re-used, remove existing cabling. At existing infrastructure locations not being re-used, provide blank cover plates in color matching wall at each location.
      e. Video projection screen.
   7. Installation, configuration, and training for new Sound and AV systems and equipment as follows at the Auditorium:
      a. Sound reinforcement system, to include all supporting amplification.
      b. Digital Signal Processing system for use with preamplification, processing, and routing of audio sources, to include all supporting network devices and companion electronics.
      c. Bluetooth portable audio device connectivity.
      d. Digital mixing console.
      e. Onstage, back-of-house, and Lobby AV monitoring systems, for stage monitoring.
      f. Wired and wireless production intercom systems.
      g. Wired and Wireless Microphone systems.

h. FM and Wifi Assistive listening systems for hearing-impaired accessibility.
i. Video encoding and distribution devices.
j. Video projection systems.

8. Installation, configuration, and training for new Sound and AV systems and equipment as follows at the Black Box:
   a. Sound reinforcement system, to include all supporting amplification.
   b. Digital Signal Processing system for use with preamplification, processing, and routing of audio sources, to include all supporting network devices and companion electronics.
   c. Bluetooth portable audio device connectivity.
   d. Compact digital mixing console.
   e. Wired production intercom system.
   f. Wired and Wireless Microphone systems.
   g. Auditorium listen-through and production intercom.
9. Loose equipment package including microphones, stands, and cables for flexible use throughout the facility.
10. Cable, connectors, wall plates, and other hardware and accessories, as required, to furnish a complete working system.

1.3 SCOPE OF THE WORK

A. These Specifications, together with the related drawings and General Conditions of the contract, comprise the requirements for the AV Systems for the project.

B. Furnish, deliver, erect, install and connect completely all of the material and appliances described herein and in the Drawings, and supply all other incidental material and appliances, tools, transportation, etc., required to make the work complete, and to leave the Sound Systems in first class operating condition, excluding those items listed under GENERAL, 1.10, RELATED WORK IN OTHER SECTIONS.

C. Perform all assembly of equipment, wiring and inter-connection and soldering of wires to jacks, devices, terminals or equipment, using technical employees only, who are experienced in the installation of AV equipment and its inter-connection. Coordinate final utility rough-in locations with actual equipment furnished.

D. Verify dimensions and conditions at the job site prior to installation, and perform installation in accordance with these Specifications, manufacturers' recommendations and all applicable code requirements.

1.4 QUALITY ASSURANCE

A. The intent of these Specifications is to describe and provide for complete AV Systems of high professional quality and reliability. Professional performance standards by the AV Systems Contractor (hereafter referred to as Installer) and the equipment will be required.

B. In all cases, the Owner and Consultant shall determine the acceptability of the work based upon the visits, observations, and reports of the AV Systems Consultant (hereafter referred to as Consultant).

1.5 SUBSTITUTIONS

A. Refer to Division 01 for specific substitution procedures and submittal requirements.

B. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted.

C. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the Consultant. Requests for substitution shall be submitted in writing and forwarded to the Consultant no less than five (5) business days prior to the project's scheduled bid date. No substitution will be accepted without written approval from the Consultant to the Installer.

D. Requests for substitution, when forwarded by the Installer to the Consultant, are understood to mean that the Installer represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified, that the same guarantee will be provided for the substitution as for the specified product, and that the Installer will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

E. Substitutions will not be considered if they are indicated or implied in Shop Drawing submissions without previous formal request, or, for their implementation, they require a substantial revision of the Contract Documents in order to accommodate their use.

F. Space allocations and utility rough-ins have been designed on the basis of equipment items named by manufacturer and model number. If any equipment not so named is offered which differs substantially in dimension or configuration from the named equipment, provide scaled shop drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project. The Installer shall coordinate final utility rough-in locations with actual equipment furnished.

G. Many Basis of Design products are specific as to infrastructure requirements, and such infrastructure has been specifically designed for the Basis of Design products listed. Where substitute equipment requiring different arrangement or connections from those shown in the Contract Documents is accepted by the Consultant, install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, making all necessary incidental changes without increasing the Contract amount. Facilitate revisions and modifications with impacted disciplines and trades, and pay all additional costs incurred by adjoining or connecting trades for implementation of such modifications.

H. All requests for substitutions shall be submitted five (5) business days before the bid opening date. Substitutions shall be requested and approved in writing only, based upon these criteria.

1.6 INSTALLER QUALIFICATIONS

A. The work performed under this Section shall be performed by an AV Systems contractor, normally engaged in the business of AV Systems installation. The prospective contractor shall show proof, as part of the bid that the contractor has been in the AV Systems installation business for a period of not less than five years and has successfully completed projects of similar size and scope.

B. Each bidder shall hold a current, valid franchise for the major lines of sound equipment furnished by him under these Specifications.

C. The Owner and Consultant reserve the right to reject any bids submitted by firms without sufficient experience in projects of similar size and scope.

1.7 COOPERATION AND COORDINATION

A. Cooperate and coordinate as shown with the other contractors who are responsible for work not included in this section.

B. Provide any and all information as shown or requested by the Owner, Consultant, or General Contractor in order for this work to be completed to the satisfaction of the Owner, and in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases. All written correspondence shall be copied to the Consultant.

1.8 GUARANTEE AND WARRANTY

A. Guarantee all parts, labor, and workmanship furnished under this contract for a period of twelve months from the date of substantial completion.

B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

C. Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.

D. Furnish complete and working AV Systems. Be of maximum assistance to the Owner during the guarantee period of the system, to the degree that maximum Owner satisfaction is assured.

E. After completion of the work, the Installer shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both parties. Incremental warranties for completed portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Installer.

1.9 SHOP DRAWINGS AND SUBMITTALS

A. Completely detailed shop drawings shall be prepared prior to the procurement of equipment or commencement of work. Electronic files of select drawings will be made available to the Installer from the Consultant. A digital files disclaimer shall be signed and returned by the Installer to the Consultant prior to release of such files. The available drawings shall include only: (1) Legend/Power requirements, (2) Conduit Riser, (3) Floor and Reflected Ceiling Plans, (4) Section Views. Drawings shall be prepared and submitted in electronic format, and as directed by the Architect. Equipment lists, data sheets, etc. shall be 8-½” x 11" size, properly bound into a single electronic format file. Submit in accordance with Division 1, General Requirements.

B. Within 10 days after the notice to proceed, submit to the Consultant identical copies of the following for approval:
   1. A complete equipment list, with manufacturers' names, model numbers, and quantities of each item.
   2. Manufacturers' data sheets on all equipment items.
   3. Equipment rack layouts showing locations of all rack mounted equipment items.
   4. Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8”=1'-0", showing loudspeaker locations and orientation, junction box and wall plate locations, and all other related device locations.
   5. Proposed construction details for any manufacturer-supplied, third party, and custom fabricated items, including interface panels, patch panels and patchbays, wall plates, speaker mounts and rigging details. These details shall show dimensions, materials, finishes and color selection.
   6. Coordinate with the Architect / Owner regarding color selection of each equipment item and associated mount / mounting hardware for any, and all, exposed devices. Provide factory color options for review in submittal package. The Installer shall request written confirmation from the Architect / Owner on all such devices prior to

ordering. Where the Architect's color selection is not a factory color option, the Installer shall coordinate with the device manufacturer for custom color/paint, where available, and, if not available, coordinate with the General Contractor and other trades for field painting.

7. Comprehensive system schematics, showing detailed connections to all equipment, with wire numbers, terminal block numbers, and color coding.
8. Riser diagrams showing conduit requirements with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
9. Electrical power requirements for head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with the electrical contractor, showing exact conduit requirements and locations for power service receptacles.
10. Certain other submittals as noted elsewhere in this specification, and as may be required for various equipment items prior to construction, fabrication, or finishing of that item.
11. Submission of the AV Contract Documents / Bid Documents does not constitute a legitimate submittal and will not be accepted.

C. Incomplete submittals will not be reviewed. Complete Shop Drawings and Product Data shall be submitted as a singular submittal.

D. All final documentation shall be submitted and approved before final acceptance by the Owner will be granted. Submit the following in accordance with Division 1, General Requirements. The Installer shall provide final documentation in both hard copy and electronic formats. Suitable electronic formats include Microsoft Word and Excel, AutoDesk (.dwg, .dwf), and Adobe Acrobat (.pdf)

1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codes. System performance measurements as noted elsewhere in this specification shall be documented. Include diagrams or charts showing final settings of all control knobs in the system (mixers, equalizers, power amplifiers, etc.). Submit copies of software settings of each piece of equipment that is software controlled.
3. Network configuration and routing settings for all network-connected equipment in scope including, but not limited to, the following:
    a. Full IP settings and addressing for each device.
    b. Network switch configurations, to include settings for VLANs, QoS, DiffServ, IGMP, and any other setting required for proper AV-network performance.
    c. Configuration and routing parameters for any Audio / AV-over-IP protocol, to include Dante, QLan, AES67, AVB, Milan, or any other standard protocol, variant, or proprietary communication platform.
4. Complete equipment rack layouts showing locations of all rack mounted equipment items.
5. Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8"=1'-0", showing loudspeaker locations and orientation, wall plates, rack locations, and other related device locations.
6. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
7. Repair parts lists for each and every major equipment item furnished.
8. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
9. Technical Systems Operations Manual, custom-written by the Contractor, for the

purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

10. Incomplete submittals will not be reviewed.

1.10 RELATED WORK IN OTHER SECTIONS

A. All conduit with pull strings, all electrical pull boxes, and all outlet boxes shall be furnished and installed under the electrical section of Division 26. Coordinate as necessary for proper installation.

B. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed under the electrical section of Division 26. The 120VAC power to the equipment racks shall be terminated inside the racks to AV Installer-supplied isolated ground multi-circuit modular raceway receptacles.

C. An insulated THW stranded copper ground wire, sized according to NEC, shall be installed under the electrical section of Division 26 from the equipment racks sheet metal to the primary ground point within the building, and terminated at each end to bare metal using approved connectors and clamps.

D. All built-in millwork and any grille cloth shall be furnished under other sections.

E. Advisory electrical circuits shown in the AV System drawings are for reference only in depicting the number of electrical circuits needed for operation of these systems.

F. Advisory datacomm circuits shown in the AV System drawings associated with the building data network are for reference only in depicting the number of network drop locations needed for operation of these systems.

1. Datacomm circuits associated with the dedicated AV-NET data network are wholly within the AV Contractor’s scope of work, as specified in this Section and shown in the accompanying drawings.

G. Broadband signal feeds.

H. Satellite signal feeds and equipment.

PART 2 PRODUCTS

2.1 GENERAL

A. All items shall be new and unused.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Refer to Part 1.5 SUBSTITUTIONS of this Specification Section.

2.2 WIRE & CABLE

A. All wire and cables shall be new and unused.

B. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire-rated and meet all applicable codes. Plenum-rated cable can only be used, if at all, in locations specified in the associated AV-series drawings. The systems contained in the

system package are designed around standard PVC jacketed cable and EMT conduit.

C. Any and all exposed exterior cabling shall be UV rated.

D. Furnish and install the following, in quantities and lengths as required. Equivalent cable from other manufacturers may be considered.

E. Voice coil loudspeakers:
1. High frequency devices (bi/tri-amped systems only): West Penn 226 14AWG twisted pair.
2. Mid frequency devices and speaker monitor circuits (bi/tri-amped systems only): West Penn 227 12AWG twisted pair.
3. Low frequency and Full-Range devices: West Penn HA210 10AWG twisted pair.

F. Constant voltage (70.7-volt) loudspeaker cable:
1. Runs of less than 200 feet: West Penn 225 stranded 16AWG jacketed twisted pair.
2. Runs of 200’ to 300’: West Penn 226 stranded 14AWG jacketed twisted pair.
3. Runs of 300’ to 500’: West Penn 227 stranded 12AWG jacketed twisted pair.
4. Runs of 500’ or more: West Penn HA210 stranded 10AWG jacketed twisted pair.

G. Audio Cable:
1. Microphone-level audio cable (installed in conduit, not portable): West Penn Wire 452 stranded 22AWG twisted pair with foil shield.
2. Line-level audio cable and all inter-rack audio cable: West Penn Wire 452 stranded 22AWG jacketed twisted pair with foil shield.
3. Exterior and below-grade Microphone and Line level cable: West Penn AQ293 stranded 18AWG twisted pair with foil shield.

H. Production Intercom cable (installed in conduit, not portable):
1. 1-Channel: West Penn 293 stranded 18AWG twisted pair with foil shield.
2. 2-Channel: West Penn D440 2-pair stranded 18AWG twisted pair with individual foil shield per pair.
3. 4-Channel: West Penn D442 4-pair stranded 18AWG twisted pair with individual foil shield per pair.
4. Outdoor Production Intercom Cable (exposed directly to sunlight/weather or installed in conduit below grade): West Penn AQ293 stranded 18AWG twisted pair with foil shield.

I. Wireless microphone and RF Assistive Listening System antenna cable:
1. For runs less than 50 feet: Belden 9310, 50-ohm RG-58A/U coaxial cable with appropriate connectors.
2. For runs that exceed 50 feet: Belden 9914, 50-ohm RG-8A/U type coaxial cable with appropriate connectors.

J. Data cable (copper) for networked Audiovisual systems:
1. Installed Data cable: Panduit PUR6AV04*-G 23AWG Cat6a UTP, or approved equal conforming to project / Owner standard. * = color.
2. Data Patch cables: Panduit UTP28X*^ series 28AWG Cat6a UTP patch cables, or approved equal conforming to project / Owner standard. Provide in lengths required for applicable devices. * = length, ^ = color.

K. Fiber-Optic Cable for networked Audiovisual systems:
1. Panduit Opti-Core FOIRZ02Y 50µm OM4 2-strand Multimode Duplex Fiber Cable, or approved equal conforming to project / Owner standard and conforming to network switch SFP+ transceiver mode and wavelength specifications.

L. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and

number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.

M. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

2.3 JACKS, CONNECTORS, AND WALL PLATES

A. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.

B. Floor-mounted jacks, unless noted otherwise, shall be installed in floor boxes. The interior plates shall be anodized black. Nomenclature shall be engraved into the interior plate of each floor box with 1/8” block letters filled with white paint. Coordinate floor box insert connector plates with actual floor boxes provided.

C. For non-standard custom panels, connectors shall be installed on 1/8” thick black anodized aluminum or brushed stainless steel panels. Nomenclature shall be engraved into the plate with 1/8” block letters filled with contrasting paint color. Coordinate final finish selection with Architect prior to Shop Drawing submittals.

D. All other jacks shall be installed on standard brushed stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8” block letters filled with black paint.

E. All AV signal circuit locations shall be numbered logically and consecutively for each circuit/signal type, starting from one (1).

F. All plate-mounted jacks at exterior locations shall be provided with captive sealing covers.

G. Unless otherwise specified, all jacks and connectors for the AV Systems shall be as follows, or approved equal:
   1. Audio connectors:
      a. Microphone and line-level input jacks (XLR type): Neutrik NC3FD-L-B-1 3-pin female XLR panel-mount jacks with gold-plated contacts.
      b. Audio output jacks (XLR type): Neutrik NC3MD-L-B-1 3-pin male XLR panel-mount jacks with gold-plated contacts.
      c. Production Intercom chassis mounted connectors: Neutrik NC6MSD-L-1 6-pin XLR Male conforming to Switchcraft pin configuration, or approved equal by Switchcraft.
      d. Female cable-end audio connectors: Neutrik NC3FX-B 3-pin female XLR connectors with gold-plated contacts.
      e. Male cable-end audio connectors: Neutrik NC3MX-B 3-pin male XLR connectors with gold-plated contacts.
   2. Video and RF connectors:
      a. BNC chassis mounted connector (75-Ohm): Neutrik NBB75DFIX Isolated UHD/4K BNC Bulkhead Jack.
      b. BNC chassis mounted connector (50-Ohm): Amphenol Connex 112443 BNC Bulkhead Jack.
      c. BNC cable mounted connector (75-ohm): Canare BCP-D series 12G-SDI 4K/UHD rated crimp cable connectors, model(s) sized for video cable type(s) provided.
   3. Loudspeaker connectors:
      a. Chassis mounted speaker connectors: Neutrik NL4MPXX 4-pole locking jack, or approved equal.
      b. Cable mounted speaker connectors: Neutrik NL4FXX-W-* 4-pole locking plug, or approved equal. * = Provide model variant appropriate for cable O.D. for each assembly.

4. Network Data connectors:
   a. CAT6A chassis mounted connector: Neutrik NE8FDX-Y6-B CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations.
   b. CAT6A chassis mounted connector (IP65 Rated): Neutrik NE8FDX-Y6-W CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations, and integrated sealing cover. These devices are associated with any configuration at a non-conditioned or exterior location.
   c. CAT6A cable connectors: Panduit FP6X88MTG Cat6a straight field term plug, or approved equal conforming to project / Owner standard.
5. Fiber optic connectors:
   a. Fiber optic chassis mounted connector: Neutrik OpticalCON DUO NO2-4FDW-A with duplex LC feedthrough socket and (4) solder contacts. Provide Neutrik SCNO-FDW-A captive sealing cover at each location.
   b. Field-terminated fiber optic connectors shall not be accepted. Contractor shall fusion splice factory terminated duplex LC pigtails or patch cords of appropriate mode and wavelength to installed fiber optic cabling associated with AV System equipment.
6. Power Sequencing Remote Low-Voltage connectors:
   a. Provide connectors for use with remote connections for power sequencing switch sets and standalone sequenced power modules. Connectors shall be in an industry standard form factor with an uncommon pin configuration to alleviate any mis-connection from standard audio, production intercom, or DMX systems.
   b. Chassis-mount 4-pin XLR male: Neutrik NC4MD-L-B-1 4-pole male receptacle with gold contacts and black metal housing.
   c. Chassis-mount 4-pin XLR female: Neutrik NC4FD-L-B-1 4-pole female receptacle with gold contacts and black metal housing.
   d. Cable-mount 4-pin XLR male: Neutrik NC4MX-B 4-pole male cable connector with black metal housing and gold contacts.
   e. Cable-mount 4-pin XLR female: Neutrik NC4FX-B 4-pole female cable connector with black metal housing and gold contacts.
7. Power connectors:
   a. Chassis mounted: Neutrik NAC3MPX-TOP chassis-mounted power inlet connector.
   b. Portable power cable assembly: 25-foot 12/3 SJO flexible power cable terminated in Neutrik NAC3FX-W-TOP at one end and 15-amp Edison plug (Nema 5-15 male) at the other.

H. Furnish and install the required number of jacks and connectors as indicated on the drawings.

2.4 EQUIPMENT RACKS

A. Furnish equipment racks for use in housing Audiovisual equipment including, but not limited to, power amplifiers, signal processors, input/output devices, playback equipment, intercom equipment, etc., and ancillary devices necessary to the operation of the system. Provide a ¼" (nominal) non-conductive industrial-grade black rubber mat under each floor-mounted cabinet trimmed to the footprint of the cabinet for isolation from building structure.

B. Each equipment rack shall include a locking front and rear doors, side panels, and top and bottom panels unless otherwise noted.

C. Equipment rack colors shall be flat black.

D. Heat-producing components shall be mounted with one RU blank panel installed between units, or as the manufacturer recommends. Fill all other unused portions of rack front

sections with matching blank panels

E. Furnish (5) sets of spare keys for each equipment rack.

F. All mounting screws shall be theft resistant.

G. Install the required number of units, of sufficient size to accommodate the equipment specified, at the locations indicated in the drawings.

H. At locations / systems with power sequencing, configure so that power amplifiers and active loudspeakers are the last to turn on in system power-up sequence and first to turn off in power-down sequence.

I. Furnish and install the following, or approved equal:
   1. Floor Mounted Equipment Rack (ER): Middle Atlantic Products WRK-44SA-32 stand-alone equipment rack, to include rear door, FD-44 locking solid front door, WRK-RR-44 rear rack rail kit and MW-4QT-FC integrated fan top for each cabinet, as required. Provide all accessories as required for proper installation and support of all devices at each location. Provide (1) Middle Atlantic WL-60 worklight for each unit supplied. (Qty: 1 ea.)
   2. Technical Equipment Desk (DSK-*): HSA Rolltops INSEXT-II Inspire Extended Rolltop with PLUS4 4” additional work surface height, and INSRKWIDE option to accommodate AV Installer-supplied slide-out rotating rack at side rack bay. At side rack bay, provide and install Middle Atlantic Products SRSR-4-16 slide-out rotating rack. Coordinate with the Architect and Owner regarding finish/color options prior to ordering. (Qty: 2 ea. desk systems. * - A = Audio, L = Lighting)
   3. Wall Mounted Equipment Rack (WR) at Auditorium stage: Middle Atlantic Products DWR-35-22, to include FD-35 locking solid front door. (Qty: as shown)
   4. Wall Mounted Equipment Rack (WR) at Black Box: Middle Atlantic Products DWR-24-26, to include FD-24 locking solid front door. (Qty: as shown)
   5. Portable Mixer Rack at Black Box: Grundorf Tour8 series model T8-TLR1224-TF1B mixer rack for specified mixing console, to include RRR Rear Rack Rail and TLR8-24-LC2B Caster Base with two brakes. (Qty: 1 ea.)
   6. Multi-circuit Power Sequencing at Auditorium:
      a. Power Sequencer Controller at “ER” Rack: Middle Atlantic Products USC-6R sequencing controller. Provide Middle Atlantic Products MPR series modular raceways at each rack with RLM-20IGA (20-amp sequenced isolated ground) and M-20IGA (20-amp non-sequenced isolated ground) power modules, and RLM-20-1CA (20-amp sequenced stand-alone modules for remote locations/equipment); provide configuration and all manufacturer accessories to support requirements shown on associated Advisory Audiovisual Power Requirements drawing sheet detail. Interface control contacts with AV control system for system power control via touch control screens. Coordinate with the Div. 26 Electrical Contractor for termination of 120VAC circuits associated with the power sequencing system raceway modules. Configure so that all power amplifiers are cycled off first and powered on last, in order to avoid transients/pops potentially harmful to loudspeakers. (Qty: as required)
   7. Single-circuit Power Sequencing at Black Box:
      a. Middle Atlantic Products PDS-620R single-circuit sequenced power distribution unit. Interface control contacts with AV control system for system power control via touch control screens. Configure outlet sequence order so that amplifiers are turned on last and powered down first. (Qty: 1 ea.)
   8. Rackmount Power Strip: Middle Atlantic PD-920R-NS. (Qty: as required to accommodate power for multiple rack mounted devices served from single power circuit at fixed rack locations)
   9. Rackmount Power Strips with Retractable Front Light: Radial Engineering POWER-2.

(Qty: as shown)
10. Sliding Rack Shelf: Middle Atlantic SS Sliding Rack Shelf. (Qty: as shown)
11. Brush Grommet Panel: Middle Atlantic BR1. (Qty: as shown)
12. Rack shelves:
    a. Middle Atlantic U1 1RU rack shelf. (Qty: as shown)
    b. Middle Atlantic U2 2RU rack shelf. (Qty: as shown)
13. Rack Blank Panels:
    a. Middle Atlantic BL1 1RU black brushed and anodized blank panel. (Qty: as shown)
    b. Middle Atlantic BL2 2RU black brushed and anodized blank panel. (Qty: as shown)
14. Rack Vent Panels:
    a. Middle Atlantic VT1 1RU black powder coat vent panel with 64% open area. (Qty: as shown)
    b. Middle Atlantic VT2 2RU black powder coat vent panel with 64% open area. (Qty: as shown)
15. Rack Drawers:
    a. Middle Atlantic D3 3RU Rackmount Drawer. (Qty: as shown)
16. Rack Recessing Panels:
    a. Middle Atlantic RR2-3RCN Rack Rail Recessor, 2 rack units (pair), 3” deep. (Qty: as shown)
    b. Middle Atlantic CN1032-50 Cage Nuts for recessors (50-count). (Qty: as required)

2.5 DIGITAL SIGNAL PROCESSOR

A. The audio processing shall be in the digital domain following the input source and shall remain until power amplification is required.

B. All network connections to be coordinated with the Owner’s network representatives. The Owner’s IT department to set-up static IP addresses in association with the Installer.

C. Provide all data interconnection cabling as shown.

D. System programmer shall be QSys Level 2 certified or otherwise advanced manufacturer-certified for programming any respective approved substitute DSP product/system.

E. Include all licensing for DSP plug-ins and Dante™ routing by software, as required.

F. The system processor shall provide up to 64 x 64 networked audio channels individually configurable as either Q-LAN or AES67 formatted networked audio. Additionally, the system processor shall include 8 x 8 Software-based Dante network audio channels and is licensable for up to 32 x 32 Software-based Dante capacity. Software-based Dante channels used subtract from the overall 64 x 64 network audio capacity.

G. The system processor shall support an 8-channel total analog I/O capacity and shall be presented as 8 Flex Channel I/O which shall be software definable as analog inputs or outputs in single channel increments in any combination ratio.

H. The system processor shall have the following front panel controls and indicators: Unit ID button and Power On blue LED. Device Status, monitoring, and logging shall be provided by a standard web interface. On the rear panel, the system processor shall have two 3-pin RS232 Euro Block Connectors, 8 GPI general purpose control inputs on a 10-pin Euro Block Connector, 8 GPO general purpose control outputs on a 10-pin Euro Block Connector, USB C and B connectors to support AV bridging with QSC Q-SYS cameras and/or present itself as one or more multi-channel USB audio interfaces. Q-SYS Network: LAN A RJ45 1000 Mbps only, LAN B: RJ45 1000 Mbps only.

I. The system processor shall operate from a single design, which can be comprised of components, wiring, links, text, and graphics on a single or multiple schematic pages. Designs shall include any of the following DSP function blocks, test and measurement components, control components, and layout components: Acoustic Echo Cancellers, SIP Softphone instances, USB Audio host and device blocks, Audio Players, Audio Streaming components, Crossfaders, Crossovers, Delay components, Auto Gain control elements, Compressors, Gates, Duckers, Expanders, Ambient Noise Compensators, Limiters, Gain blocks, Graphic Equalizers, Parametric Equalizers, FIR Filters, All-Pass Filters, Band-Pass Filters, Band-Stop Filters, High-Pass Filters, Low-Pass Filters, FIR High-Pass filters, FIR Low-Pass Filters, Dual-Shelf Equalizers, Notch Filters, Meters, Matrix Mixers, Gain-Sharing Automatic Mixers, Gated Automatic Mixers, Signal Routers, Public Address Routers, Room Combiners, Signal Presence Meters, Tone Generators, Tone and Noise Generators, Dual Trace FFT Measurement Modules, Real Time Analyzers, Signal Injectors, and Signal Probes.

J. The system processor shall support custom user control interfaces on either proprietary touch screen controllers, network computers utilizing a control application, iOS devices, or any device with a standard web browser. Custom control interfaces shall be capable of having multiple user-selectable pages with different controls on each. All GUI's shall be submitted to the consultant for approval prior to programming and finalization.

K. Furnish and install the following as indicated in the accompanying Audiovisual drawings, or approved equal:
1. Digital Signal Processor (DSP): QSC Q-Sys CORE 8-FLEX. (Qty: as shown)
2. DSP Audio input expander: QSC Q-Sys QIO-ML4i expander with 4 mic/line inputs with +48VDC phantom power. (Qty: as shown) Provide manufacturer's rackmount kit(s), as required, to support all DSP expander devices.
3. DSP Audio input/output expander: QSC Q-Sys QIO-ML2x2 expander with 2 mic/line inputs with +48VDC phantom power and 2 line outputs. (Qty: as shown). Provide manufacturer's rackmount kit(s), as required, to support all DSP expander devices.
4. DSP Control expander: QSC Q-Sys QIO-GP8x8 expander with 8 logic inputs and 8 logic outputs. (Qty: as shown) Provide manufacturer's rackmount kit(s), as required, to support all DSP expander devices.
5. Rackmount Touch Control Panel: QSC TSC-70-G3 7" touch control panel, to include mounting bracket. This device is associated with the WR wall rack on stage. (Qty: as shown)
6. Desktop Touch Control Panel: QSC TSC-70-G3 7" touch control panel, to be supplied with TSC-710T-G3 desktop stand accessory. (Qty: as shown)
7. Type "BT" Bluetooth / Multi-I/O wall plate: Attero Tech by QSC unD6IO-BT Dante Networked Audio Wall Plate, to include matching 2-gang decora cover plate. (Qty: as shown)
8. Type "C" Touch Control Screen: QSC TSC-70-G3 7" touch control panel, to include mounting bracket. (Qty: as shown)
9. Network Switch: Netgear M4250-26G4XF-PoE+ (GSM4230PX) 26-Port switch with 24x 1G PoE+ RJ45 ports, 2x 1/10GbE ports (Non-PoE+), 4x 1/10GbE SFP/SFP+ ports, 480W PoE+ power budget. (Qty: as shown)
10. Multimode Transceivers for Network Switches: Netgear AXM761 10GBase-SR short reach 10G multimode transceiver with LC duplex connector for use with OM3/4 MM fiber. (Qty: as shown)
11. Type "AP" Wireless Access Point: Netgear WAX620 PoE-powered dual-band 802.11ax Wi-Fi access point. This device is dedicated to the AV system data network and is not associated with any building network functionality. (Qty: as shown)

L. Successful Contractor shall be responsible for programming each software configuration file for each system based on intended functionality shown, or implied, in the drawings. Each system shall be programmed so the default operating condition is auto-populated upon

system power-up. Interface with the presentation and control system at each applicable space and program associated touch control panels for user control of all parameters necessary for successful control and operation of connected devices in each system. At locations where touch control screens are intended to be the mechanism by which system power is controlled, program touch control screens for this functionality, ensuring associated DSP and Network Switch devices are powered from non-sequenced power outlets. Terminate and program fire alarm interface at each system. Each system shall be programmed to mute all program audio upon receipt of contact closure from the addressable fire alarm module, provided by fire alarm vendor, at each system location. Contractor shall provide a review copy of the programming file to the Consultant for review at the latest four (4) weeks prior to scheduled commissioning trip.

2.6 LOUDSPEAKERS

A. The drawings indicate the loudspeaker positions and aiming points for each loudspeaker.

B. Loudspeakers shall be mounted to the structure, at the positions and angles indicated relative to the aiming points. Suspend each component with commercial rigging hardware, in such a way as to facilitate minor angle adjustments. Safety factor shall be at least 5. Furnish rigging details during submittal process. Secure any loose hardware to prevent vibration and rattling. Orient each speaker at the location and angles indicated in the drawings. Make minor adjustments as required to provide even sound distribution.

C. Measure and record the impedance of each driver at the amplifier terminals. High frequency drivers shall be measured at 1000Hz; low frequency drivers shall be measured at 250Hz. Include the measurements in the final documentation.

D. For loudspeakers incorporating 70.7v transformers/autoformers, tap as indicated in the drawings.

E. Retain the services of a registered professional structural engineer licensed to practice in the State of project installation to develop mounting details, including attachment to the building structure. Structural information shall include design calculations and a copy of engineer's certification.

F. Verify factory color option selection with Owner / Architect prior to product acquisition.

G. Furnish and install the following assemblies, or approved equal:
   1. Type "S1" Loudspeaker Arrays: ElectroVoice EVA series Expandable Vertical Array. Provide all rigging and manufacturer's mating and flying hardware, as required, for safe suspension at each location. Refer to drawings for configuration at each location. (Qty: 2 total loudspeaker array systems). Loudspeaker systems consist of one or more of the following components; refer to drawings for each array configuration:
      a. ElectroVoice EVA-2082S/906 dual 8" 2-way array module with 90°x6° dispersion.
      b. ElectroVoice EVA-2082S/920 dual 8" 2-way array module with 90°x20° dispersion.
      c. ElectroVoice EVA-2082S/1220 dual 8" 2-way array module with 120°x20° dispersion.
      d. ElectroVoice EVA-2151D dual 15" subwoofer.
      e. ElectroVoice EVA-EG Extended Rigging Grid.
      f. ElectroVoice EVA-GXB Extra Spreader Bar for rigging grids.
   2. Type "S2" Loudspeaker: ElectroVoice EVF-1122S/96 12" loudspeaker with 90H°x60°V dispersion. To be supplied with EVF-UB mounting yoke. Mount in horizontal orientation and rotate horn, as required, for 90H°x60°V configuration. (Qty: as shown)

3. Type “S4” Loudspeaker: QSC AD-S8T 8” 70V loudspeaker with nominal 105° conical dispersion. For each unit supplied, provide YMS8T yoke mount. (Qty: as shown)
4. Type “S5” Loudspeaker: QSC E112 12” loudspeaker with 85° conical dispersion. To be supplied with E12YM yoke mount and TMB Pro-Burger PRBHC3/8B 2” pipe clamp for mounting at Black Box pipe grid. (Qty: as shown)

2.7 CEILING-RECESSED LOUDSPEAKER ASSEMBLIES

A. Furnish ceiling-recessed loudspeakers at the locations noted on the drawings.

B. Ceiling-recessed speakers shall be installed in a recessed enclosure, whether it be a separate back can or part of an integrated loudspeaker assembly. Furnish braces designed to provide additional support to the weight of the speaker and prevent tile sag. Coordinate exact locations with the Owner. Connect the loudspeakers as indicated in the drawings. Furnish enclosures/back cans to Division 26 for installation if/where required.

C. Verify factory loudspeaker color with Architect prior to product acquisition. Baffles shall be painted a color selected by the Arch./Owner. Coordinate with the Architect regarding color selection.

D. Tap the transformers as indicated in the drawings. Measure and record the impedance at 1000Hz of each home run at the amplifier terminals. Include the measurements in the final documentation.

E. Furnish and install the following, or approved equal:
1. Type “S3”: Electrovoice EVID C6.2 6.5” 2-way 70v recessed ceiling speaker assembly. (Qty: as shown)

2.8 PORTABLE LOUDSPEAKERS

A. Furnish portable loudspeakers with accessories for flexible use.

B. Furnish the following, or approved equal, passive monitor speakers at the Auditorium:

C. Furnish the following, or approved equal, passive monitor speakers:
1. JBL PRX412M 12-inch 2-way Stage utility / monitor speaker. (Qty: 6 ea.)
2. Whirlwind NL4-050 “speakon” speaker cable – 50 feet. (Qty: 6 ea.)
3. Whirlwind NL4-100 “speakon” speaker cable – 100 feet. (Qty: 2 ea.)

D. Furnish the following, or approved equal, passive monitor speakers at the Black Box:

E. Furnish the following, or approved equal, passive monitor speakers:
1. JBL PRX412M 12-inch 2-way Stage utility / monitor speaker. (Qty: 2 ea.)
2. Whirlwind NL4-050 “speakon” speaker cable – 50 feet. (Qty: 2 ea.)

2.9 POWER AMPLIFIERS

A. Provide power amplifiers for use in amplifying audio signals for distribution to the loudspeakers.

B. Each power amplifier shall have an analog input connector which is either a screw-type barrier strip or XLR type. Networked amplifiers shall incorporate RJ-45 data jacks for network signal and/or control connectivity. Output connectors shall be either barrier strip or Neutrik Speakon connectors. Other types of connectors shall not be accepted. All power amplifiers shall have detented stepping input level controls. Install the units in the main equipment racks and connect as indicated in the drawings.

C. Provide (1) one amplifier channel for each loudspeaker home run. Size amplifier based on

total power consumption of each home run. Locate amplifiers at sound equipment racks associated with each loudspeaker home run / zone.

D. Furnish and install the following, or approved equal:
1. 4-channel network amplifier compatible with specified DSP, 700 watts/ch max. @ 8-Ohms and 70V, 800 watts/ch max. @ 4-Ohms: QSC CX-Q-2K4. (Qty: as shown)
2. 4-channel network amplifier compatible with specified DSP, 1,250 watts/ch max. @ 8-Ohms and 70V, 2,400 watts/ch max. @ 4-Ohms: QSC CX-Q-8K4. (Qty: as shown)
3. 8-channel network amplifier compatible with specified DSP, 1,000 watts/ch max. @ 8-Ohms, 4-Ohms, and 70V: QSC CX-Q-4K8. (Qty: as shown)
4. 8-channel network amplifier compatible with specified DSP, 1,250 watts/ch max. @ 8-Ohms and 70V, 1,500 watts/ch max. @ 4-Ohms: QSC CX-Q-8K8. (Qty: as shown)
5. 2-channel amplifier, 400 watts/ch max @ 8-Ohms: QSC GXD4. (Qty: as shown)

2.10 VOLUME CONTROLS

A. Furnish wall-mounted volume controls at locations indicated for use in controlling loudspeaker levels within each respective area.

B. Size each device per total speaker load at each respective location / zone.

C. Furnish and install the following, or approved equal:
1. Type “V”: Lowell Manufacturing **LVC-* 1-gang volume control (**=power rating, *=color). (Qty: as shown)

2.11 PLAYBACK, RECORDING, AND INTERFACE DEVICES

A. Furnish audio devices to facilitate the use of pre-recorded content or portable media. Connect as indicated on the drawings.

B. Furnish and install the following, or approved equal:
1. CD/Media Player with Bluetooth, Aux, and USB inputs: Denon DN-500CB. (Qty: as shown)
2. Media Recorder: Denon DN-300R-MKII. For each unit supplied, provide (1) one Sandisk Extreme Pro USH-I SDXC 512GB SD Memory Card. (Qty: as shown)
3. Projector Audio Interface: RDL TX-J2 Stereo Unbalanced to Mono Balanced Summing Transformer. This device is associated with the Black Box. Provide patch cable from projector (projector by Technology) to Summing Transformer. (Qty: as shown)

2.12 MIXING CONSOLES

A. Furnish a mixing console for use in processing and routing microphone and line level sources.

B. Provide remote mixing capabilities with wireless tablet via the AV Network Wi-Fi.

C. The mixing console shall have the I/O specified and be configured on the built-in Dante network interface.

D. Configure the console prior to commissioning and provide configuration file to consultant for review.

E. Configure all Dante enabled devices, including wireless microphones and audio recorders, on the console.

F. Configure all routing of signal from console to DSP, via Dante into the Q-SYS platform.

G. Furnish and install the following at the Auditorium, or approved equal:
1. Digital Mixing Console: 120 mix channels, 48 mix and 12 matrix output busses, 32 in / 16 out local I/O, 24 + 4 master fader configuration, 144x144 Dante digital audio networking: Yamaha DM7. (Qty: 1 ea.)
2. I/O Rack: 32 analog input, 16 analog output, 8 AES/EBU digital outputs, Dante digital audio networking, remote head-amp control from specified mixing console: Yamaha Rio3224-D2. (Qty: 1 ea.)
3. Wireless controller: Apple iPad Air 64GB Wifi model (verify color). To be provided with Otterbox Defender Series Pro case compatible with tablet model supplied. (Qty: 1 ea.)

H. Furnish and install the following at the Black Box, or approved equal:
1. Compact Digital Mixer: 32 mix channels with 16 local mic/line inputs, 16+1 fader configuration, and 20 output busses: Yamaha TF-1. Mount at Black Box portable mixer rack. (Qty: 1 ea.)
2. I/O Rack: 16 analog input, 8 analog output, Dante digital audio networking, remote head-amp control from specified mixing console: Yamaha Tio1608-D2. Mount at Black Box “WR” rack. (Qty: 1 ea.)
3. Headphones: Audio Technica ATH-M70X. (Qty: 1 ea.)

2.13 WIRELESS MICROPHONE SYSTEMS

A. Diversity UHF wireless microphone systems shall be used in this facility.

B. Operating frequency shall be as high as possible, and shall be selected so as to avoid interference.

C. The Contractor shall perform a Wireless Frequency Scan in order to determine the proper frequency selection for each venue.

D. Units are to be provided with rackmount kits, in the configurations shown in the accompanying drawings, and installed in equipment racks, whether fixed or portable racks, for use at each applicable venue.

E. Each system shall be provided on different frequencies so that they can be used simultaneously.

F. Furnish and install the following wireless systems and accessories, or approved equal, for production use at the Auditorium:
1. Shure ULXD4Q Quad-channel digital wireless receiver. (Qty: 6 ea.)
2. Shure ULXD2/SM58 Wireless handheld transmitter. (Qty: 8 ea.)
3. Shure ULXD1 Wireless bodypack transmitter. (Qty: 24 ea.)
4. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner’s representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 24 ea.)
5. Shure UA874US Active Directional Antenna, compatible with frequency range(s) of receivers supplied. (Qty: 2 ea.). Remote-mount at type “WL-A” antenna locations.
6. Shure UA845UWB Active Antenna Distribution Unit. (Qty: 2 ea.)
7. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 32 ea.)
8. Shure SBC800-US 8-Bay battery charging station, to include power supply. (Qty: 4 ea.)

G. Furnish and install the following wireless systems and accessories, or approved equal, for default / assembly use at the Auditorium:
1. Shure QLXD124/85 Combination System with QLXD4 digital wireless receiver, QLXD2/SM58 handheld transmitter, and QLXD1 bodypack transmitter. (Qty: 2 ea.). Remote-mount supplied ½-wave omni-directional antennas at type “WL-B” antenna

locations.

2. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 2 ea.)
3. Shure UA221 Passive Antenna Splitter Kit. (Qty: 1 ea.)
4. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 4 ea.)
5. Shure SBC200-US 2-Bay battery charging station, to include power supply. (Qty: 2 ea.)

H. Furnish and install the following wireless systems and accessories, or approved equal, for flexible use at the Black Box:
1. Shure QLXD124/85 Combination System with QLXD4 digital wireless receiver, QLXD2/SM58 handheld transmitter, and QLXD1 bodypack transmitter. Mount included ½-wave omni-directional antennas at portable mixer rack rear rack panel. (Qty: 2 ea.).
2. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 2 ea.)
3. Shure UA221 passive antenna splitter kit. (Qty: 1 ea.)
4. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 4 ea.)
5. Shure SBC200-US 2-bay battery charger with power supply. (Qty: 2 ea.)

2.14 PRODUCTION INTERCOM SYSTEM

A. Provide a production intercom system for use in voice communication and personnel coordination during events where indicated in the drawings.

B. Furnish intercom power supplies in sufficient quantities to accommodate all intercom devices per manufacturer's specifications and recommendations for each system.

C. Refer to associated Audiovisual drawing package for all device, outlet, and equipment locations.

D. Furnish and install the following, or approved equal at the Auditorium:
1. Clear-Com MS-702 master intercom station. Furnish (1) GM-18 gooseneck microphone for each unit supplied. (Qty: 1 ea.)
2. Clear-Com PS-702 2-channel power supply. (Qty: 1 ea.)
3. Clear-Com RS-702 2-channel wired intercom belt pack. (Qty: 12 ea.)
4. Type "IW": Clear-Com KB-702GM 2-channel wired speaker wall station. Provide GM-9 gooseneck microphone for each unit supplied. (Qty: as shown)
5. Clear-Com CC-300 single muff intercom headset w/ flexible dynamic boom mic. (Qty: 12 ea.)
6. Clear-Com IC-25-2P 25-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 8 ea.)
7. Clear-Com IC-50-2P 50-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)
8. Clear-Com FSII-BASE-II-5 FreeSpeak II wireless base station with licensing for 5 wireless beltpacks. This device can operate in the 1.9GHz and 2.4GHz frequency bands. Provide and configure CCM Core Configuration Manager, on one (1) computer selected by the Owner, for configuration of wireless intercom system parameters. (Qty: 1 ea.)
9. Clear-Com FSII-BP19 FreeSpeak II 1.9GHz wireless beltpack. For each unit supplied, provide CC-300 single muff intercom headset w/flexible dynamic boom mic. (Qty: 5 ea.)
10. Clear-Com FSII-TCVR-19-US FreeSpeak II 1.9GHz Transceiver Antenna. Mount at type "WC" locations. (Qty: 2 ea.)

11. Clear-Com BAT60 rechargeable battery. (Qty: 5 ea.)
12. Clear-Com AC60 5-unit charger, to include power supply. (Qty: 1 ea.)

E. Furnish and install the following, or approved equal at the Black Box:
1. Clear-Com PS-702 2-channel power supply. (Qty: 1 ea.)
2. Clear-Com RS-702 2 channel wired intercom belt pack. (Qty: 6 ea.)
3. Clear-Com CC-300 single muff intercom headset w/ flexible dynamic boom mic. (Qty: 6 ea.)
4. Clear-Com IC-25-2P 25-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)

2.15 ASSISTIVE LISTENING SYSTEMS

A. Furnish and install FM wireless assistive listening systems for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of broadcasting on 57 channels and be frequency agile.

B. The receiver shall have a programmable multi-function Listen button that can be tuned for the venues desired channels and electronically lock out any unused channels. The receiver shall have a signal-to-noise ratio of 70 dB or greater and shall have an audio frequency response of 50 Hz - 15 kHz (±3 dB). The device shall employ a unique DSP SQTM noise reduction technology. The unit shall have a programmable squelch circuit. The unit shall incorporate a multi-functional display that indicates battery status, inventory number and channel. The device shall have the option of being lanyard or belt clip worn and the lanyard shall have the option of an integrated neck loop. The device shall have a USB connector used for inventory control, set up, charging and firmware upgrades. The device shall incorporate automatic battery charging circuitry and use a non-proprietary lithium ion battery. The device shall have additional charging contacts to allow multiply charging options.

C. Supplemental transmission is provided via an assistive listening WiFi server distributed through the building WiFi wireless network. Personal reception is accomplished with a user-installed smartphone app, facilitating wireless connectivity to Bluetooth-enabled hearing aids.

D. Furnish and install the following installed systems, or approved equal, at the Auditorium:
1. Listen Technologies LS-55-216 iDSP Prime Level 3 Stationary RF System (216 MHz), to include (1) transmitter with rackmount kit, (4) rechargeable personal receivers, (4) intelligent Earphone/Neckloop lanyards, (4) universal ear speakers, 12-unit charging tray, ALS notification signage kit, and accessories. (Qty: 1 complete system)
2. Listen Technologies LA-124 90° Helical Antenna (216 MHz). Remote mount at “AL” location. (Qty: 1 ea.)
3. Listen Technologies LW-100P-02 2-channel WiFi server. Coordinate with the Owner’s IT staff for connection to building wireless network. (Qty: 1 complete system)

E. Furnish and install the following installed systems, or approved equal, at the Black Box:
1. Listen Technologies LS-55-216 iDSP Prime Level 3 Stationary RF System (216 MHz), to include (1) transmitter with rackmount kit, (4) rechargeable personal receivers, (4) intelligent Earphone/Neckloop lanyards, (4) universal ear speakers, 12-unit charging tray, ALS notification signage kit, and accessories. (Qty: 1 complete system)
2. Listen Technologies LA-124 90° Helical Antenna (216 MHz). Remote mount at “AL” location. (Qty: 1 ea.)

2.16 VIDEO / DATA PROJECTORS

A. Furnish and install high light output video projectors for projection of video, data, and graphic images on the projection screens in the areas as indicated.

B. Perform all setup procedures and image convergence for each input according to the manufacturer's recommendations. The image shall be adjusted for full available screen width for each input.

C. Coordinate the exact location of the projector mount with the Architect and Project Manager/Designer. Provide exact location to ensure that the image fills the projection screen and all necessary details in shop drawings.

D. Provide all hardware as required for a complete mounting system, to include, but not be limited to, pipe extension columns, column accessories, and structural ceiling adaptors/mounts for suspension from structure above at suitable mounting height for proper alignment and imaging. Secure the projector to structure with anti-vibration mounts/devices at the location shown in the AV Drawings. Safety factor shall be at least five. Retain the services of a registered professional structural engineer licensed to practice in the State of installation to develop mounting details, including attachment to the building structure. Structural information shall include design calculations and a copy of engineer's certification.

E. Verify factory color options for projector, mounting devices, and any required accessories with the Arch / Owner prior to ordering.

F. Provide with input modules, if/as required per projector model, to satisfy the requirements and connectivity shown in the associated drawings.

G. Projector models shall employ a laser-based light source.

H. Based on throw distance, screen size, and required lens option, the supplied projection system shall provide approximately 75 foot-lamberts at the screen.

I. Verify lens and screen photometrics in field prior to ordering.

J. Furnish and install the following, or approved equal:
   1. Type VP: Epson EB-PU2216B 13K Lumen native WUXGA 3-chip LCD laser projector with ELPLM11 Middle Zoom #4 lens. Provide Chief WMA2S Heavy Duty Dual Stud Wall Mount, VCMU Heavy Duty Universal Projector Mount, HBU Universal Interface Bracket, and 1.5" NPT Column Extension in length(s) required. (Qty: 1 ea.)

2.17 PROJECTION SCREENS

A. Furnish and install all projection screens in the areas as indicated. Verify locations with architect prior to installation. Refer to architectural drawings for exact locations.

B. Install the projection screens only when clean and controlled environments are present.

C. Each screen to have a flat tensioned viewing surface. Surface to be held taut and wrinkle free, eliminating edge curl. The viewing surface shall be seamless.

D. All painting, metalwork, and woodwork shall be completed prior to installation, to protect against damage by other contractors.

E. The screens shall be delivered to the job site, still in factory crating, while access is still available for screens of these dimensions. Store the screens in such a way as to protect them from moisture and adverse weather conditions. Take all precautions necessary to protect the screens from damage during storage and installation. Projection screens must remain in a climate-controlled environment at all times.

F. Furnish and install the following, or approved equal:
   1. Draper Ultimate Access XL V 226" Diagonal (120"H x 192"W) motorized projection

screen in 16:10 aspect ratio with XT1000VB Matt White viewing surface and LVC-IV low-voltage interface. Provide maximum black drop available for screen size. (Qty: 1 ea.)

2.18 FLAT PANEL DISPLAYS

A. Furnish commercial flat panel displays and associated mounting devices at locations and in configurations indicated for use with the video distribution system.

B. Coordinate with the Architect and Owner regarding exact locations and specific conditions.

C. Provide all cabling and mounting device accessories associated with each display type. Coordinate mounting at all locations, to include surface-mount and wall-recessed conditions.

D. Furnish specified devices at each and every location represented in the drawings.

E. Furnish and install the following, or approved equal:
1. Type TV-A: Samsung QM65C 65” 4K/UHD LED Display with Chief LTM1U Large Tilt Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown.)
2. Type TV-B: Samsung QM55C 55” 4K/UHD LED Display with Chief TS318TU Large Thinstall Dual Swing Arm Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown)
3. Type TV-C: Samsung QM43C 43” 4K/UHD LED Display with Chief MTM1U Medium Tilt Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown.)
4. Dual Rackmount Display: Marshall Electronics ML-702 Dual 7” rackmount monitor with HDMI, 3G-SDI, and Composite video inputs. (Qty: as shown)

2.19 NETWORK MEDIA ENCODING AND DECODING

A. Furnish devices for use with encoding and decoding of Audiovisual signals over the dedicated AV-NET audiovisual data network. Devices shall support Gigabit Ethernet connectivity, and local DC or remote PoE+ power.

B. Devices shall support up to, and including, 4K and UHD video resolution with ultra-low latency and visually lossless video. HDMI 2.0 and HDCP 2.2 shall be supported.

C. System control shall be natively supported within the Audio DSP environment. Program Audio DSP system and associated touch control panel for individual encoder and decoder routing control to each endpoint location.

D. Program associated audio routing within the specified Audio DSP system for each space via software Media Stream Receiver and Media Stream Transmitter devices.

E. Furnish and install the following:
1. Wall Plate Media Encoder at type “1” locations: Visionary Solutions 5-Series E5-WP-BT-BLACK Wall Plate Video Encoder with Bluetooth Audio. (Qty: as shown)
2. Wall Plate Media Encoder at type “FB1” location: Visionary Solutions 5-Series E5-WP-H-BLACK Wall Plate Video Encoder. (Qty: as shown)
3. Wall Plate Media Encoder at DSK-A Control Desk: Visionary Solutions 5-Series E5-WP-H-BLACK Wall Plate Video Encoder. Provide FSR SMWB-2G (black) surface-mount wall box for mounting at desk control surface. Mount surface-mount wall box to desk as shown. (Qty: as shown)
4. Media Decoder at type “VP” Video Projector location: Visionary Solutions 5-Series D5100 Decoder. (Qty: as shown)
5. Media Decoder at type “TV-A” Flat Panel Display locations: Visionary Solutions 5-Series D5100 Decoder. (Qty: as shown)
6. Media Decoder at type “TV-B” Flat Panel Display locations: Visionary Solutions 5-

Series D5100 Decoder. (Qty: as shown).

7. Media Decoder at type “TV-C” Flat Panel Display locations: Visionary Solutions 5-Series D5100 Decoder. (Qty: as shown)
8. Media Encoder at type “ER” AV Equipment Rack: Visionary Solutions 5-Series E5100 Encoder. Mount at “ER” rack as shown. (Qty: as shown)
9. Rackmount Accessories: Provide Visionary Solutions AVIP-RACKMOUNT-3 rack kit and AVIP-BLNK-1 blanking plate, as required to support rackmount configurations shown. (Qty: as required)
10. NDI to HDMI Converter: Magewell ProConvert NDI-to-HDMI Decoder. (Qty: as shown)

2.20 DIGITAL SIGNAGE PLAYER

A. Provide network-based devices for use in distributing digital media throughout the facility areas prescribed by these Specifications and associated Audiovisual drawing sheets. Devices shall be used for the scheduling and distribution of Digital Signage content. The system shall be capable of real-time operation via headend or remote computer(s) for all digital signage appliances.

B. The Digital Signage system shall incorporate management software and at least one (1) media player. Management software, and firmware for all hardware devices, shall be the most current available at time of installation.

C. The management software shall support the planning, scheduling, distributing and monitoring of media to players and shall provide administrative tools for control, automation and data integration (one, many, or all players). The management software shall provide content authoring tools within the system platform. Content creation is beyond the Installer’s scope of work, however, the Installer shall create, or otherwise obtain, files including multiple media types/formats supported for testing and demonstration purposes.

D. Players shall support up to 4k/60p resolution.

E. Physical connections shall include Gigabit Ethernet port with PoE+, GPIO port, 3.5mm IR port, and HDMI output.

F. The system shall support H.265 video codec for 4k content, H.265, H.264 (MPEG-4 Part 10), MPEG-2 and MPEG-1 for Full HD content. Supported media formats shall be .ts, .mov, .mp4, .mkv, .mpg, .vob, .m2ts, and .wmv. Supported image formats shall be BMP, JPEG, PNG. Supported audio formats shall be MP2, MP3, AAC, FLAC, OGG, and WAV (AC3 is passed through).

G. Adhere to the manufacturer’s specifications, guidelines, and recommendations pertaining to appropriate network configuration practices in order to maximize the application of these systems in this facility. Coordinate with the Owner’s building IT staff for appropriate implementation of such practices for a fully operational and properly functioning network-based digital media distribution system as intended. Coordinate with the Owner’s building IT staff for IP address assignments and to ensure that switches, ports, VLAN’s, etc. are configured per manufacturer recommendations for optimum distribution and performance.

H. Provide all specified devices in the quantities and configurations as designated in this Section, as well as the accompanying Audiovisual drawing sheets. Provide software licenses to support all devices in the system.

I. Provide all required data and AV cabling between controllers/media players and associated source and/or destination devices for proper operation.

J. Any television reception equipment and associated conversion and/or distribution to the

display locations is beyond the scope of work in this Section and shall be provided by the Owner at the Owner's discretion.

K. Digital Signage Content Creation is beyond the scope of this specification.

L. Furnish and install the following, or approved equal:
1. BrightSign HD225 Digital Signage Player. Mount at rack on rackshelf as shown. (Qty: as shown)
2. BrightSign BrightAuthor Connected creation, publishing, and management software application. Coordinate with the Owner's representative regarding installation of this software at one (1) required management computer location. (Qty: as required)

2.21 VIDEO CAMERAS

A. Furnish a pan/tilt/zoom video camera for use with program streaming and recording of events in each applicable venue.

B. Units shall provide simultaneous NDI and HDMI outputs. Devices shall be powered remotely via either PoE+ (IEEE802.af) or remote DC power supply.

C. Each unit shall be supplied with manufacturer's wall mount or accessory housing, as specified.

D. Furnish and install the following at the Concert Hall, or approved equal:
1. Type "CA" camera: Lumens VC-A61PN 4K NDI / HX PTZ Camera with VM12 Wall Mount. (Qty: as shown)

2.22 MICROPHONES, STANDS, CABLE, AND DIRECT BOXES

A. Furnish microphones, stands, cables, and Direct Boxes for flexible use throughout the facility.

B. Each microphone shall be equipped with its own cable, with Neutrik connectors installed on each end.

C. Furnish and install the following:
1. PTT Paging Microphones: Telex NC450D noise-cancelling dynamic push-to-talk paging microphone. Terminate to Neutrik NC3MRX right-angle XLR-male plug and install at off-stage left WR AV wall rack. Provide Magnetic Mic conversion kit (part# MMSU-1) and replace factory mounting clip for magnetic mounting at rack plate. Configure/program to address dressing rooms, scene shop, and black box with software ducker to duck associated program audio when paging is engaged. (Qty: as shown)
2. Recording Microphones at Catwalk "M3" location: AKG C451B reference small diaphragm cardioid condenser microphone. Provide Wilkinson ORTF-CLIP for stereo recording, Ace Backstage #43 Mic Hanger Slug, and suspend as indicated in associated drawing package. (Qty: 2 ea.)
3. Ambient Microphone at Catwalk "M3" location: Audix M1255B Mini Cardioid Condenser Microphone. Suspend as indicated in associated drawing package. (Qty: 1 ea.)
4. Suspended Choir Microphones over Stage: Audix M1255B Mini Cardioid Condenser Microphone. Coordinate with Owner's representative for preferred locations. (Qty: 4 ea.)

D. Furnish the following loose items for flexible use at the Auditorium:
1. Crown/AKG PCC160 Phase-Coherent Cardioid boundary microphone. (Qty: 4 ea.)
2. Shure SM58-LC Cardioid Dynamic Vocal Microphone. (Qty: 2 ea.)

3. Shure SM57-LC Cardioid Dynamic Instrument Microphone. (Qty: 6 ea.)
4. Shure SM81 Cardioid Condenser Instrument Microphone. (Qty: 2 ea.)
5. Shure SM137 Cardioid Condenser Instrument Microphone. (Qty: 2 ea.)
6. Sennheiser MD421-II Large Diaphragm Cardioid Dynamic Instrument Microphone. (Qty: 2 ea.)
7. Atlas Sound DS-5E Desktop microphone stand, black. (Qty: 2 ea.)
8. Atlas Sound MS20E heavy duty microphone stand, black. (Qty: 12 ea.)
9. Atlas Sound PB21XEB adjustable boom with counterweight, black. (Qty: 6 ea.)
10. Atlas Sound TB3664 tripod microphone stand with boom, black. (Qty: 4 ea.)
11. Atlas Sound TB1930 short tripod microphone stand with boom, black. (Qty: 4 ea.)
12. Whirlwind MKQ25NP-BLACK 25-foot microphone cable. (Qty: 8 ea.)
13. Whirlwind MKQ50NP-BLACK 50-foot microphone cable. (Qty: 10 ea.)
14. Whirlwind MKQ100NP-BLACK 100-foot microphone cable. (Qty: 8 ea.)
15. Whirlwind L15 Leader 15-foot instrument cable. (Qty: 2 ea.)
16. Radial Engineering JDI passive direct box with Jensen transformer. (Qty: 1 ea.)
17. Radial Engineering PRO-AV2 passive stereo multimedia direct box. (Qty: 1 ea.)

E. Furnish the following loose items for flexible use at the Black Box:
1. Shure SM58-LC Cardioid Dynamic Vocal Microphone. (Qty: 4 ea.)
2. Atlas Sound TB3664 tripod microphone stand with boom, black. (Qty: 4 ea.)
3. Whirlwind MKQ25NP-BLACK 25-foot microphone cable. (Qty: 2 ea.)
4. Whirlwind MKQ50NP-BLACK 50-foot microphone cable. (Qty: 4 ea.)
5. Whirlwind L15 Leader 15-foot instrument cable. (Qty: 2 ea.)
6. Radial Engineering JDI passive direct box with Jensen transformer. (Qty: 1 ea.)
7. Radial Engineering PRO-AV2 passive stereo multimedia direct box. (Qty: 1 ea.)

PART 3 EXECUTION

3.1 INSTALLATION

A. Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment and labor necessary for the complete installation of the systems, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

B. Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Part 2 of these Specifications.

C. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator.

D. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.

E. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to ensure that constant polarity is maintained. Balanced audio connectors shall be wired as follows:

WIRE	CONNECTOR	SIGNAL
BLACK	PIN#3 or RING	LOW or NEGATIVE
RED or WHITE	PIN#2 or TIP	HIGH or POSITIVE

BARE	PIN#1 or SHIELD	GROUND

F. Provide all audio circuits balanced and floating, except as noted in the Specifications or directed by the Consultant at the time of final equalization and testing. Shields of audio cables shall be grounded at one end only, at the inputs of the various equipment items in the system.

G. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone level, line level, amplifier output, 120VAC, intercom, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with plastic cable ties. Cables and wires shall be continuous lengths without splices.

H. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heatshrink type tubing shall be used to insulate and dress the ends of all wire and cables. Include a separate tube for the ground or drain wire.

I. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.

J. All solder joints and terminations shall be made with resin-core silver solder.

K. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.

L. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.

M. Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool which has been approved by the manufacturer of the connectors. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.

N. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections, at the front and back of the rack, with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspection.

3.2 SOUND SYSTEMS FINAL TESTING AND EQUALIZATION

A. The completed AV Systems shall be physically inspected by the Consultant to assure that all equipment is installed in a neat and professional manner, and in accordance with this Section. The AV Systems shall be tested by the Consultant, BAi, Austin, TX. Contact BAi at 512-476-3464 at least 4 weeks in advance of requested check-out dates for scheduling. Provide jobsite photos, confirming substantial completion of the AV Systems, to the Consultant for review when requesting check-out dates.

B. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

C. During the testing and equalization work, the Installer shall have on the job site one (1) competent technician who is familiar with the project, and who will be prepared to stay as

long as his services are needed. It is estimated that approximately eight (8) hours will be required for this work.

D. The process of equalizing and testing the system may necessitate moving and adjusting certain loudspeakers. Adjustments shall be performed without claim for additional payment.

E. Coordinate as necessary to ensure a totally quiet room during the AV Systems testing and balancing period.

F. Prior to requesting systems testing, verify the following:
1. All systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive system noise beyond published specifications of the equipment, hum, RF interference, or instability of any form.
2. All specified equipment is on the job site for proper accounting.
3. All loudspeaker circuits have been tested, are connected to the proper crossover frequency, and are in perfect working order. Furnish impedance measurements of each circuit prior to final tests.
4. All equipment controls are labeled, even if unused. If permanent labels cannot be furnished prior to system inspection, temporarily label every control as to its function with write-on tape. Supply labels or markers suitable for indicating knob settings after equalization is performed.
5. Operation manuals for every equipment item furnished are on hand at the job site.
6. Installer shall provide all signal processing software loaded on a portable PC and ready for use at time of testing. Installer shall provide a calibrated RTA and microphone, and pink noise generator at time of testing.

G. Should the performance testing show that the Installer has not properly completed the systems, the Installer shall make all necessary corrections or adjustments and a second demonstration shall be arranged at the Installer's expense.

H. The final acceptance of the system by the Owner will be based upon the report of the Consultant following inspection, testing, and demonstration. A list of items in need of completion or correction shall be generated by the Consultant, which must be corrected by the Installer before final acceptance will be granted.

3.3 SOUND SYSTEM PERFORMANCE

A. After equalization and testing, the sound system shall meet or exceed the following specifications:
1. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference, and instability of any form.
2. Maximum SPL with band-limited pink noise input to the system shall be:
a. Auditorium: Maximum SPL with band-limited pink noise / program material input to the system shall be 93 dB before audible distortion occurs, spatial variation +/- 3dB at 4kHz, frequency response uniform to +/- 2 dB, 32 Hz to 16 kHz.

3.4 OWNER TRAINING AND FAMILIARIZATION

A. The Installer shall furnish the Owner's representatives with training necessary to properly operate the systems. Demonstrate in detail all functions of the systems. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose. These training sessions shall be videotaped by the Installer and copies provided to the Owner with the as-built documentation.

B. The Installer shall attend one scheduled event, as selected by the Owner, to assist and troubleshoot, as necessary, in initial user operation of these systems.

C. The training phase shall be accompanied by complete as-built documentation and the custom technical systems operation manual, as described in Part 1.09 of this Specification Section.

END OF SECTION 27 41 15

SECTION **2 41 AUDIOVISUAL SYSTEMS**

PART 1 - GENERAL

1. 1 RELATED WORK

A. 26 05 00 – Grounding and Bonding
B. 26 05 29 – Electrical Hangers and Supports
C. 27 10 00 – Structured Cabling System
D. 27 51 00 – Public Address and Wireless Clock System

1. 2 General

A. This section identifies the requirements, technical design, and specifications for the audiovisual systems at Fort Bend ISD George Bush High School located in Richmond, Texas (“Owner”). The audiovisual systems as specified are industry standard and may include (but not be limited to) the following: flat panel display(s), flat panel display mounting hardware, projector and projector screen, audio visual switching and distribution equipment, audio systems, microphone systems, speaker systems, and audiovisual hardware as specified.
B. Proposing Contractor shall include materials, equipment, and labor necessary to provide a complete and functional audiovisual system regardless of any items not listed or described in this specification or the associated drawings.
C. Proposing Contractor shall verify presence and proper operation of all OFE prior to beginning work.
D. It is strongly recommended that each Proposing Contractor perform a site visit to determine any site conditions that may impact the installed system cost prior to submitting a bid and/or submittals. Failure to perform a site visit does not release the Contractor from responsibility for any existing conditions.
E. This project requires advanced configuration and programming of Control Systems and Integrated Video Conferencing System. Contractor will be required to have a background in the programming of these and all manufacturer required certifications.

1. 3 QUALITY ASSURANCE

A. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer’s maximum available product warranty.
B. All individuals installing the audiovisual system must be full-time employees of the authorized dealer and at least 75% of the installation staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor’s product submittals.
C. The Proposing Contractor (“Bidder”) and the Installing Contractor (“Contractor”) must be the same company for the entire scope of work for audiovisual. No subcontractor to the Proposing Contractor will be allowed for any portion of the audiovisual scope of work.
D. The Audiovisual System Installer shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audiovisual industry and shall provide a reference list of (3) projects of similar cost, scope, and complexity. Contractor shall provide the following information for each project: project name, project location, project completion date (Month/Year), brief description of project, major components, and client point of contact name/information. Reference projects must be from proposed office location for the project.
E. The Bidder shall have an authorized office within (75) miles of the project’s location and all installation and service staff shall be based out of said office. The owner reserves the right to perform an on-site inspection.
F. The Bidder shall provide 24-Hour support, 7 days a week within 2 hours during normal business hours and 4 hours during non-business hours during the warranty period. Contractor shall expect for any corrective work to be performed during non-business hours or after school hours. Normal business hours shall be defined as 7:30 AM – 4:30 PM Monday through Friday with the exception of federal holidays. Non-business hours shall be defined as any time that does not fall within the normal business hours previously defined.

G. The Bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
H. Contractor shall have an Infocomm / Avixa CTS-D certified employee overseeing the submittal and record drawings of the audiovisual systems.
I. Contractor shall have an Infocomm / Avixa CTS-I certified employee overseeing the installation of the audiovisual systems.
J. The Contractors CTS-D and CTS-I certified employees shall be full-time employees as defined by the Internal Revenue Service (IRS) of the Contractor.
K. Contractors CTS-I certified employee shall be onsite at any and all times when installation work is being performed to supervise installation personnel.
L. Contractors CTS-I certified employee shall be present for the following meetings/events:

Low voltage preinstallation meeting.
Audiovisual system pathway mockup.
Audiovisual systems functionality mockup.
Owner walks / System inspections.
Coordination meetings.
Substantial completion punch.
11-month warranty inspection.
Other events as requested by the Owner and/or Combs Consulting Group.

M. The Contractor shall include a one (1) year labor, materials and workmanship warranty on the work performed in the execution of all projects to include any alterations or changes to the scope of the projects through system completion and system acceptance. The warranty period shall not commence until all system commissioning is 100% complete and accepted by Fort Bend ISD Design Manager in writing.
N. The Contractor shall inspect all installed equipment and systems (11) months after the warranty period begins (11-month warranty inspection) and correct any and all deficiencies / other warranty items found during said inspection.

1. 4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:

Latest Local Codes and Amendments
Latest applicable National Electrical Code (As designated by the project).

B. Additional References:

TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
ISO/IEC 1180 Generic Cabling Standard
EN 50173 Generic Cabling Standards for Customer Premises
ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts

If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1. 5 SUBMITTAL REQUIREMENTS

A. Contractor shall provide the following submittals required for the project.

Part 1- Qualifications and Product Data
Part 2- Submittal Drawings

Part 3- Audiovisual Control System Submittal

B. Contractor shall provide the following documentation as part of the submittal package. Partial submittals will not be accepted unless project needs on an expedited request for an individual product (Example, lead time issues, back boxes, etc.).

C. Part 1- Qualifications and Product Data may be submitted prior to Part 2 and Part 3 completion.

D. Qualifications and Product Data

Provide all documentation confirming requirements noted in section 1.03 QUALITY ASSURANCE.
Manufacturer Product Certifications (Project Specific) for Company, Installers and Programmers including Subcontractors. (Crestron, Extron, Biamp, etc.)
Line by line conformance review of the specifications. Any variance from the specification will be annotated and an explanation given.
Itemized list of all equipment and materials. Any substitution or approved equal products must be clearly noted in submittal.
Itemized list of all equipment and materials including any substitutions that were approved and any proposal discrepancies. This list shall contain quantity, manufacturer, part number and description to provide a complete and functional audiovisual system.
Manufacturer product specification sheets for all audiovisual products and cabling.
For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.
Submit specification sheets only. Do not submit a user or operator's manual in lieu of a specification sheet. If a specification sheet is not available from the manufacturer, submit a catalog page or the specification appendix (only) from the operation manual. PDF of the specification section of the product from the manufacturer's website is acceptable.
Provide a Warranty Statement that contains specific details on the contractors' Warranty being proposed for this scope of work.
Contractor shall not order, purchase, or install any equipment until Product Data submittal has been accepted in writing by the Owner/Consultant.
For systems featuring wireless microphone systems provide the proposed wireless microphone frequencies.

E. Submittal Drawings

Submittal drawings shall include system line diagrams, floor plans (include projector installed distance from screen with dimensioned distance), rack elevations, and/or detail drawings as required. Shop drawings shall be submitted electronically in pdf format on a 30"x42" paper size. Shop drawings shall not contain copies of or snippets of or depictions of Combs Consulting Group's drawings.
Submittal drawing shall provide floor plans with audiovisual devices located and identified.
Submittal drawings shall provide major cabling pathways and termination locations noted on drawings.
Submittal drawings shall provide point-to-point wiring diagrams for devices and control as indicated on COMBS Signal Flow drawing for all components.
Submittal drawings shall include cabling and device labeling scheme.
Shop drawings shall be provided clearly depicting any proposed modification to the project drawings. Any modifications shall be highlighted on the shop drawings.
Submittal drawings shall be updated as project change requests and field condition changes are completed. Current submittal drawings shall be utilized for Record Drawing or As-Built drawings.
Contractor shall maintain a set of submittal / shop drawings on site at all times and shall update the shop drawings on a weekly basis. Consultant drawings and specifications shall be made available during the installation of the project for reference. Both sets of drawings are the responsibility of the Contractor to provide and maintain. Drawings shall be made available for inspection at the request of the Owner / Consultant.

F. Audiovisual Control System Submittal

Provide the control system submittal prior to initiating any substantial programming work and/or production of custom produced keys/labeling. Do not proceed with custom work until the proposed work product is approved in writing.
Proposed touch panel/keypad control layouts for each room/panel.
Initial touch panel/keypad control layouts will be required for each room/panel as part of the submission. Contractor will design and modify control interface(s) based on Owner feedback. Contractor shall

participate in an initial control system kick-off meeting along with progress meetings to review control system layout and design with the owner to ensure the control system fully meets the Owner's needs and expectations.
Contractor shall fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology and final results.
Contractor will also be expected to make reasonable adjustments to completed control systems based on Owner feedback once system is in use.
Once initial system programming is implemented; allow owner a (2) month period to utilize the system and make comments. Revisions to the programming shall be at no cost to the owner.
After initial evaluation period coordinate with Owner, record Owner's feedback and provide adjustments as requested.

PART 2 - PRODUCTS

2. 1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.
B. Owner/Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.
C. Proposed equivalent items must be approved in writing by the Owner/Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.
D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.
E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.
F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices and intended application.
G. All wiring, equipment and installation materials shall be new and "commercial grade".
H. Labels on all wiring, materials and equipment must indicate a nationally recognized testing laboratory.
I. All new equipment shall be received, stored, and staged at the Contractor's facility until delivered and installed. Contractor shall store all materials and equipment in accordance with manufacturers' instructions in a weather-tight, secure enclosure. All equipment shall be protected from dust, debris, and environmental contamination. Contractor shall be responsible for safety and security of all Contractor furnished equipment and OFE until project close-out.
J. For systems featuring wireless microphone systems the Contractor shall coordinate the wireless microphone frequency with local conditions. Wireless frequencies shall be coordinated with system manufacturer.
K. For any device (Audiovisual rack, keypad locking cover, etc.) the Contractor shall provide (5) keys to each lock. All similar locks on the project shall be keyed alike, e.g., all keypad locking covers on the project shall be keyed alike, the locking front door of all audiovisual racks shall be keyed alike, the locking rear access door of all audiovisual racks shall be keyed alike, etc.
L. For all products available in multiple colors Contractor shall coordinate color with Owner and Architect prior to ordering.
M. Contractor is to provide all products, materials, cabling, connectors, and other items necessary to provide a complete and fully operational system as described in each systems description, to fully comply with this specification in its entirety, to fully comply with any and all applicable local and/or national codes, and any and all applicable AVIXA standards. Contractor is advised to carefully review each system description and this specification in its entirety in order to provide a fully operational system as described above. This specification is intended to only serve as an outline of each system type and does not detail each and every product/material/cable/connector/etc. that the contractor is to provide.

2. 2 AUDIOVISUAL DISTRIBUTION AND CONTROL

A. Provide turn-key AV distribution and control for each room indicated on drawings.
B. Signal Flow Diagrams on the Drawings include expected main components. Provide additional

components, accessories, and associated programming as needed to provide a fully functional Audiovisual System for each Room Type that operates as intended for all specified components.

C. Provide, Install, and Program all PoE networking switch gear required for all audiovisual equipment. All audiovisual devices requiring PoE network cabling shall be patched to the contractor provided network switch as required.

D. Network switch and programming for audiovisual switch shall be required to meet the manufacturer's recommendations and requirements for the IP based communications system for manufacturer such as Crestron /QSC controls system and QSC audio system.

E. Provide a complete and tested integrated audiovisual system.

F. Functionally complete audiovisual system shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether specifically called for, at no additional cost to Owner.

G. For systems which have the functionality to mute audio when a PA announcement is made, the muting functionality shall be configured so that the system audio resumes (5) seconds after the PA announcement concludes.

2.03 TYPE 1 SYSTEM: DIGITAL SIGNAGE DISPLAYS

A. Room Description

Digital signage systems shall feature a wall mounted commercial grade flat panel display on a tilting and articulating wall mount, and an in-wall storage box will be provided behind the display to house all head end equipment. All digital signage displays will receive an owner furnished-contractor installed (OFCI) digital signage player. Certain digital signage displays will receive an HDMI over HDBaseT extender. The display's factory included remote control will be used for control of the system and the displays integrated speakers will be used for audio reinforcement.

B. Products

System description

Flat Panel Display, Display Mount, AV Wall Box, and Digital Signage player by owner.

Digital Signage Displays and Accessories

Displays shall have a minimum resolution of 3,840 x 2,160, a minimum brightness of 500nits, and a minimum of (2) HDMI inputs.

Display mount shall be commercial grade and rated for the size and weight of each display.

HDMI over HDBaseT extenders shall be commercial grade, feature a wall plate transmitter, and have the capability to power the wall plate transmitter from the receiver.

Approved Devices:

1) "FPD49": Samsung QM49H (QTY as shown on drawings)
2) "FPD55": Samsung QM55H (QTY as shown on drawings)
3) "WB1": Chief PAC526F (QTY as shown on drawings, Contractor is to turn over to General Contractor for installation by Division 26)
4) Tilting Wall Mount: Chief TS525TU (QTY 1 per digital signage display)
5) "MM2": Extron DTP T HWP 4K 231 D (QTY as shown on drawings)
6) "MM4": Extron DTP HDMI 4K 230 RX (QTY as shown on drawings)
7) HDMI Receiver to Display HDMI Cable: Liberty HDPMM03F (Provide QTY 1 per "MM4")
8) End User HDMI Cable: Liberty HDPMM10F (Provide QTY 1 per "MM2")
9) 'WB1' – Chief Pac 526.
10) Approved Equal

1.1 TYPE 2 SYSTEM: CLASSROOMS F.1-103, F.1-117, F.1-118, F300, G313

A. Room Functionality and Design Intent

1. Classrooms and other rooms as identified on the drawings shall feature an interactive flat panel on a mobile cart. The interactive flat panel, mobile cart, and all other components for this system shall be Owner provided; Owner installed.

B. Products

1. All products are to be Owner provided; Owner installed.

1.2 TYPE 3 SYSTEM: FINE ARTS CLASSROOMS F.1-115, F285

A. Room Functionality and Design Intent

1. Fine Arts rooms shall feature a wall-mounted long-throw laser projector with a fixed frame wall mounted projection screen. Sources for the projector shall be two wall mounted HDMI inputs.
2. Systems shall also include two wall mounted loudspeakers and one floor standing subwoofer. Audio sources shall include the projector, two wall mounted 3.5mm stereo audio inputs, overhead choir microphones, and wall mounted XLR inputs, Choir and Band Hall classrooms shall also feature a rack mounted Bluetooth/CD/SD/USB media player.
3. Choir classrooms shall also feature four wireless microphone systems.
4. All head end audio equipment shall be installed in a rolling equipment rack with a “pop-up” style mixer rack integrated into the top of the rolling equipment rack. A custom wall plate shall be provided for connection between the rolling equipment rack and the devices installed within the rooms.
5. All audio sources will be mixed and controlled via a rack mounted mic/line mixer. A wall-mounted control keypad shall be provided to control the video system.

B. Audiovisual Control Systems

1. Control Panel
   e. Room shall utilize audiovisual room control panel.
   f. Reference drawings for location and designation.
   g. Dual gang back box and conduit to accessible ceiling required by Div. 26.
   h. Data required. Coordinate with Div. 27 cabling contractor.
   i. Provide and install all equipment and hardware to support the control systems. Test, configure and calibrate as required.
   j. Configure as white.
   k. Approved manufacturer:
      1) ‘CP1’ -- Medialink Controller with Volume Control Knob – Extron Model 60-1182-02. (QTY 1)
      1) Approved equal.

C. Multimedia Devices

1. Video Distribution
   a. Reference drawings for location and designations.
   b. Dual gang back box and conduit to accessible ceiling required by Div. 26.
   c. Data required. Coordinate with Div. 27 cabling contractor.

d. Provide and install all equipment and hardware required to support the Video Distribution System. Test, configure and calibrate all systems.
e. Provide and install the following equipment per room to support the installation of the Video Distribution System:
   1) "MM1": Extron DTP T HWP 4K 231 D (QTY as shown on drawings)
   1) "MM2": Extron DTP HDMI 4K 230 RX (QTY as shown on drawings Audio Systems.

D. Audiovisual Enclosures

1. Rolling Audiovisual Equipment Rack
   f. Provide and install all equipment and hardware to support the rack mounting system. Provide all parts and pieces required for a clean rack installation. Protect equipment racks and equipment rack hardware from damage and scratches. All damage is the responsibility of the Contractor until final system turnover regardless of the party responsible for said damage. Equipment racks should be turned over to the Owner clean, dust free and with any applicable keys.
   g. Provide all cable management hardware necessary to complete a neat cabling installation. Provide all lacing strips, 'hook and loop' and mounting hardware required. Restrict cable tie use to minimal use and when 'hook and loop' installation is not practical.
   h. Provide the following equipment and hardware for the equipment racks installation:
      1) Rolling Console Rack "EQ1" – Omnirax Model CW30. (QTY 1)
      2) Blank Panel, 1RU – Middle Atlantic Model FEB1. (QTY 3)
      3) Locking Drawer, 2RU – Hammond Model RDRW1900316RK1. (QTY 1)
      1) Rackmount Power – Middle Atlantic Model PDC-915R. (QTY 1)

2. AV Wall Box
   a. Reference drawings for location and designation.
   b. Power, rough in and conduit to accessible ceiling required by Div. 26.
   c. Data required.
   d. Integrated power and data receptacles.
   e. Approved manufacturer:
      1) Wall Box, Trim Ring and Shelves Chief PAC526

      2) Power Strip – Chief PAC526P4kit.
2. Audio Wall Plates
   a. Reference drawings for locations and designations.
   b. Back box and conduit to accessible ceiling by Div. 26 required.
   c. Approved manufacturer:
      1) Audio Connector Plate – RDL Model D-CIJ3. (QTY 1)
      2) Custom Wallplate – Panelcrafters Model CUSTOM. (QTY 1)
         a) Clear anodized with black etched text.
         b) 5- XLR Male (MIC A-D)
         c) 1- XLR Female (MIX TO AMP)

E. Video Displays

1. Projector
   a. Reference drawings for location and designation.
   b. Power required; data required.
   c. AV Contractor shall verify lens selection to as-built/site conditions and modify selection as required.
   d. Provide Projector Mounting Hardware and Projector Lens.
   e. Approved manufacturer:

1) "P1" – Epson Model PRO EB-PU2010W.
2) Projector Lens – Epson Model ELPLM10/ELPLM15
3) Fixed Frame Projection Screen – Dalite Model 21907V
4) Long Throw Projector Kit – Crimson Mounts Model JSK2F-55.

2. Projector Screen

F. Audio Systems

3. Speaker Amplifier
   a. Program the audio amplifier to provide proper protection of speaker systems. Properly initialize and setup amplified speaker systems. Provide room equalization as required and provide equalization recommended by the loudspeaker manufacturer.

   b. Provide system programming to Owner/Consultant for approval prior to programming deployment. All programming to be completed by a Biamp Certified Programmer.

   c. Provide rack mounting hardware and PA System Override. Coordinate with Paging System Provider for patch connection.

   d. Provide the following equipment per room to support the installation of the Audio Systems:

      1. Audio Amplifier – Stewart Audio Model FLX-E-320-1-CV. (QTY 1)

      2. Paging Controlled Relay – RDL Model TX-PCR1. (QTY 1)

         a) Power Supply – RDL Model PS-24AS. (QTY 1)

      3. Approved Equal.

1. Loud Speaker
   a. Reference drawings for locations and designations.
   b. AV Contractor shall determine speaker cabinet position and splay to optimize intelligibility and coherence for the space.
   c. Approved manufacturer:
      1) 'S1' – JBL Model Control31-WH. (QTY 2)
      2) Decora Brush Plate – Arlington Industries Model CED135-1. (QTY 2)
      3) 'S2' – JBL Model EON618S. (QTY 1)
      4) Component Cooler – Active Thermal Management Model Cool-Slim. (QTY 1)
      5) High Bond Mounting Pad – 3M Model VHB PADS. (QTY 1)

2. Audio Mixer
   a. Reference drawings for location and designations.
   b. Power required; data required.
   c. Installs on AV Equipment Rack 'EQ1.'
   d. Approved manufacturer:
      1) 'MX1' – Yamaha DM3 (QTY 1)

3. Wireless Microphone System

e. Reference drawings for locations and designations.
f. Wireless Microphone System applicable to Choir F.1-117 only.
g. Provide and install all equipment and hardware per room required to support the Wireless Microphone Systems. Test, configure and calibrate all systems. Assemble, configure and test all wireless transmitters.
h. Provide hand held transmitters and rack mounted receivers, antenna, and antenna distribution, and rack mounted antenna.
i. Approved manufacturer:
   1) 'MC1' -- Handheld Wireless System – Shure Model SLX24/SM58 (J3). (QTY 4)
   2) 'AT1' -- Omni-Directional Half Wave Antenna – Shure Model UA8-572-596 (J3). (QTY 2)
   3) Antenna Distribution System – Shure Model UA844 . (QTY 1)
   4) Stackable Mic Stand – Atlas Model SMS5B. (QTY 4)

4. Ceiling Choir Type Microphones
   a. Reference drawings for locations and designation.
   b. Provide service loop.
   c. AV Contractor shall determine final location and mounting height relative to coverage field (riser positions by Owner as applicable), and so that mic cable does not obstruct projector image.
   d. Approved manufacturer:
      1) 'MC2' -- Hanging Microphones – Shure Model MX202WP-A/C. (QTY 4)

5. Dynamic Microphone
   a. Provide wired, dynamic microphone, XLR cabling, and mic stands.
   b. Approved manufacturer:
      1) Dynamic Microphone – Shure Model SM58-CN. (QTY 2)
      2) Stacking Mic Stand – Atlas Model SMS5B. (QTY 2)

4. Audio Playback and Record Devices
   a. Reference drawings for location and designation.
   b. Installs in AV Equipment Rack 'EQ1.'
   c. Power required, data required.
   d. Approved manufacturer:
      1) 'AV1.' Media Player – Denon Model DN-300 . (QTY 1)
      2) HDMI Audio Extractor – Hall Research Model EMX-HD-AUD. (QTY 1)
      3) Solid State Recorder – Denon Model DN-300R. (QTY 1)
         a) 64GB SDXC Memory Card – Sony Model SF64UY2/TQ. (QTY 1)
5. Audio Transformer
   a. Approved manufacturer:
      1) Unbalanced Input Transformer – RDL Model . (QTY 2)
      2) Audio Combiner and Isolation Transformer – TDL Model AV-DC4. (QTY 1)

2.04 TYPE 4 SYSTEM: DANCE F.1-107

A. Room Functionality and Design Intent
   1. Dance Class Room systems shall feature an interactive flat panel display on mobile cart by owner.
   2. Systems shall also include four wall mounted loudspeakers and in each corner of the room.
   3. Audio sources shall include a wall mounted 3.5mm stereo audio input and Bluetooth connectivity.

4. All head end audio equipment shall be installed in a rolling equipment rack with a “pop-up” style mixer rack integrated into the top of the rolling equipment rack.
5. A custom wall plate shall be provided for connection between the rolling equipment rack and the devices installed within the rooms.

B. Audiovisual Control Systems

1. Control Panel
   a. Room shall utilize audiovisual room control panel.
   b. Reference drawings for location and designation.
   c. Dual gang back box and conduit to accessible ceiling required by Div. 26.
   d. Data required. Coordinate with Div. 27 cabling contractor.
   e. Provide and install all equipment and hardware to support the control systems.
   f. Test, configure and calibrate as required.
   g. Configure as white.
   h. Approved manufacturer:
      1) ‘CP1’ -- Medialink Controller with Volume Control Knob – Extron Model 60-1182-02. (QTY 1)
      2) Approved equal.

C. Audiovisual Enclosures

1. Rolling Audiovisual Equipment Rack
   a. Provide and install all equipment and hardware to support the rack mounting system. Provide all parts and pieces required for a clean rack installation. Protect equipment racks and equipment rack hardware from damage and scratches. All damage is the responsibility of the Contractor until final system turnover regardless of the party responsible for said damage. Equipment racks should be turned over to the Owner clean, dust free and with any applicable keys.
   b. Provide all cable management hardware necessary to complete a neat cabling installation. Provide all lacing strips, hook and loop’ and mounting hardware required. Restrict cable tie use to minimal use and when ‘hook and loop’ installation is not practical.
   c. Provide the following equipment and hardware for the equipment racks installation:
      1) Rolling Console Rack “EQ1” – Omnirax Model CW30. (QTY 1)
      2) Blank Panel, 1RU – Middle Atlantic Model FEB1. (QTY 3)
      3) Locking Drawer, 2RU – Hammond Model RDRW1900316RK1. (QTY 1)
      1) Rackmount Power – Middle Atlantic Model PDC-915R. (QTY 1)
6. Audio Wall Plates
   a. Reference drawings for locations and designations.
   b. Back box and conduit to accessible ceiling by Div. 26 required.
   c. Approved manufacturer:
      4) Audio Connector Plate – RDL Model D-CIJ3. (QTY 1)
      5) Custom Wallplate – Panelcrafters Model CUSTOM. (QTY 1)
         a) Clear anodized with black etched text.
         b) 5- XLR Male (MIC A-D)
         c) 1- XLR Female (MIX TO AMP)

D. Audio Systems

1. Speaker Amplifier
   a. Program the audio amplifier to provide proper protection of speaker systems. Properly initialize and setup amplified speaker systems. Provide room equalization as required and provide equalization recommended by the loudspeaker manufacturer.

b. Provide system programming to Owner/Consultant for approval prior to programming deployment. All programming to be completed by a Biamp Certified Programmer.

c. Provide rack mounting hardware and PA System Override. Coordinate with Paging System Provider for patch connection.

d. Provide the following equipment per room to support the installation of the Audio Systems:

1. Audio Amplifier – Stewart Audio Model FLX-E-320-1-CV. (QTY 1)

2. Paging Controlled Relay – RDL Model TX-PCR1. (QTY 1)

a) Power Supply – RDL Model PS-24AS. (QTY 1)

3. Approved equal.

2. Loud Speaker
   a. Reference drawings for locations and designations.
   b. AV Contractor shall determine speaker cabinet position and splay to optimize intelligibility and coherence for the space.
   c. Approved manufacturer:
      1) 'S1' – JBL Model Control31-WH. (QTY 4)
      2) Decora Brush Plate – Arlington Industries Model CED135-1. (QTY 4)
      3) 'S2' – JBL Model EON618S. (QTY 1)
      4) Component Cooler – Active Thermal Management Model Cool-Slim. (QTY 1)
      5) High Bond Mounting Pad – 3M Model VHB PADS. (QTY 1)

7. Audio Mixer
   a. Installs in AV Equipment Rack.
   b. Power required; data required.
   c. Approved manufacturer:
      1 Audio Mixer – JBL **CSMA 24**
      2 **A**□□□□□□□ □□□□□**.**
8. Audio Playback and Record Devices
   a. Reference drawings for location and designation.
   b. Installs in AV Equipment Rack 'EQ1.'
   c. Power required, data required.
   d. Approved manufacturer:
      1) Media Player – Denon Model DN-300 . (QTY 1)
      2) HDMI Audio Extractor – Hall Research Model EMX-HD-AUD. (QTY 1)
9. Bluetooth Wall Plate
   a. Reference drawings for location and designation.
   b. Install at 48" A.F.F.
   c. Power, single gang back box, and conduit to accessible ceiling by Div. 26 to accessible ceiling.
   d. Approved manufacturer:
      1) 'AT2' – RDL DB-BT1A
         a) Bluetooth Receiver (install in AV Equipment Rack) RDL TX-TPR2A
10. Audio Transformer
    a. Approved manufacturer:
       6) Unbalanced Input Transformer – RDL Model . (QTY 2)
       7) Audio Combiner and Isolation Transformer – TDL Model AV-DC4. (QTY 1)

E. Cables

a. Provide the following per room:

1. 10-FT HDMI Cable – Middle Atlantic Model 29678. (QTY 2)

2. 3-FT HDMI Cable – Middle Atlantic Model 29675. (QTY 1)

3. 3-FT 3.5mm Stereo to Two Male RCA Cable – Middle Atlantic Model 40369. (QTY 2)

4. 6-FT XLR Cable – Middle Atlantic Model 40059. (QTY 4)

5. 12-FT XLR Cable – Middle Atlantic Model 40060. (QTY 10)

6. RCA to 1/4" Stereo Cable – Hosa Model TRS-202. (QTY 2)

7. Other premade cables as required.

2. Turn-Over Cabling:

a. Provide the following per room:

1. 15-FT HDMI Cable – Middle Atlantic Model 50612. (QTY 1)

e. 12-FT 3.5mm Audio Cable – Middle Atlantic Model 40414. (QTY

2.05 CABLING AND CONNECTORS

A. All indoor cabling shall be plenum rated. All outdoor cabling shall be outdoor rated and direct burial rated when in contact with grade or within conduit in contact with grade. Coordinate all cable colors with Owner/Consultant prior to ordering or installation. Provide connectors and termination as specified by manufacturer for each application.

Provide all cabling with Black jacketing unless otherwise noted.

Acceptable manufacturers include Extron, Crestron, Belden, West Penn Wire, Gepco and Liberty. Liberty is specified to establish a cabling baseline. Cross reference equal or greater cabling and connectors when making substitutions with the acceptable manufacturers. Submit substitution requests as described in the submittal requirements section when using a manufacturer not identified as acceptable.

B. Pathway Wire Support

Panduit J-Mod Cable Support System

Erico Caddy Cat Links J-Hook Series

Panduit Plenum Rated Hook Loop (Black)

C. Fire Stop

STI Spec Seal Part Number

3M Products Part Number

D. HD-SDI □Analog Video □Genlock Cabling □CATV(RF):

<50’:

a. Liberty Cable Part 20-CMP-VID-COAX-BLK.

b. Terminate with Liberty Part CM-RG59M-BNC or Liberty Part 112975 for BNC style Connectors.

c. Terminate with Liberty Part CM-RG59M-F for ‘F’ style connectors.

50’-200’:

Liberty Cable Part 18-CMP-VID-COAX-BLK.

Terminate with Liberty Part CM-RG6M-BNC for BNC style connectors.

Terminate with Liberty Part CM-RG6L-F for ‘F’ style connectors.

E. Digital Audio Network Cabling:

Liberty Cable Part 24-4P-P-L6ASH-BLK

Foil Shielded CAT6A Cable, Black.

Terminate with Liberty Part 1401405012-I.
Use Conductive Copper Foil Tape 3M 3313 series 1-inch to bond the drain connection and the connector.
Dress uncovered copper foil tape and cable with heat shrink.
Use Igarashi IPS PH-165 or similar type non-marring plastic jaw pliers for connector compression.
Space constricted back box or bend radius restricted installations.
Terminate with Liberty A68IP A-STP keystone insert and install into a keystone plenum rated surface mount box Hubbel ISB1BKP or similar. Mount in an accessible ceiling space or accessible concealed space and run a plenum rated patch cable from the jack to the device. The plenum rated patch cable is to be same rating/quality or better than the field terminated cabling.

F. Network □USB/KVM Extension Cabling

Liberty Cable Part 24-4P-P-L6-EN-BLK.
Unshielded CAT6 cable, Black.
Terminate with Liberty Part 11108080034 RJ45 Connector.

G. HDMI □DisplayPort □DVI □USB Passive Cabling

Provide cable/signal transport of sufficient length to reach from source device to destination device. No digital cable shall exceed a length of 15 feet unless otherwise specified. Provide a high retention cable when available.
HDMI - Liberty Cable Part HDPMM Series.

H. Serial Control Cabling

Single data pair only.
Liberty Part 22-1P-CMP-E -BLK.
Two data pair RS232(RTS/CTS or RS485).
Liberty Part 24-2P-P485.
Terminate all data cabling with a reliable termination system, include hoods and retention mechanisms when available.

I. Relay □Control Cabling:

Liberty 18 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 18-2C-P-BLK.

J. Cresnet Cabling:

<500': Liberty Part LLINX-U-P.
>500': Consult with Manufacturer/Consultant prior to ordering / installation.

K. Analog Audio □Microphone □Intercom □IFB Cabling

Liberty Part 22-1P-CMP-E -BLK.
Terminate cabling with Neutrik XX series for XLR connectors. For ¼" TRS/TS, 1/8" and RCA connectors use Rean manufactured connectors.

L. High Impedance Speaker Level Cabling (25v/70v):

< 300':
Liberty 16 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 16-2C-P-BLK.
300' to 500'
Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P
Provide Cable with Black Jacket – Coordinate Cable Color with Architect.
> 500': Consult with Manufacturer/Consultant prior to ordering / installation.
Terminate when available with Neutrik "Speakon" type connectors.

M. Low Impedance Speaker Level Cabling:

< 50': Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P-BLK.
50' to 100': Liberty 12 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 12-2C-P-BLK.
> 100': Consult with Manufacturer/Consultant prior to ordering / installation.
Terminate when available with Neutrik 'Speakon' type connectors.

N. Low Voltage Power Supply Cabling:

Provide cabling of sufficient gauge and conductor count as required for power supply in use. Size cabling per manufacturer's device specific minimum required voltage drop.

O. HDBaseT Cabling

Liberty Cable part : 24-4P-P-L6ANS-BLU
Shielded Cat6A cable with non-continuity shield for HDBaseT applications.
Terminate with Liberty part : FTPSA0A

2. 6 ADDITIONAL / UNIT PRICING

A. Provide additional unit pricing if noted on drawings and specifications including additional stock devices or alternates.
B. Provide additional pricing for additional warranty years as required in specifications.
C. Provide additional pricing for warranty for (1) additional years for the entire audiovisual system.

PART 3 - EXECUTION

3. 4 CODES, STANDARDS, AND REGULATIONS

A. American National Standards Institute (ANSI)
B. American Society for Testing and Materials (ASTM)

ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)
D. Building Industry Consulting Service International (BICSI)

Telecommunications Distribution Methods Manual 13th Edition
NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling
NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Electronics Industry Alliance (EIA)
F. Federal Communications Commission (FCC)

FCC Part 15, Radiated Emissions Limits, revised 1998
FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
FCC Part 76, Cable Television Service, revised 1998

G. Insulated Cable Engineers Association (ICEA)

ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

H. International Electrotechnical Commission (IEC)
I. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code
IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

J. International Organization for Standardization (ISO)

International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999
ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

K. National Cable Television Association (NCTA)
L. National Electrical Manufacturers Association (NEMA)

NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)

NFPA-70, National Electrical Code
NFPA-101, Life Safety Code
NFPA-297, Guide on Principles and Practices for Telecommunications Systems
NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)
O. Occupational Safety and Health Administration (OSHA)
P. Telecommunications Industry Association (TIA)

ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009
ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009
ANSI/TIA -568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, 2009
ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, 2008
ANSI/TIA/EIA–569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, 2005
ANSI/TIA–569-B Amendment 1, Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
ANSI/TIA/EIA-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
ANSI/TIA/EIA-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications, 2011
ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2004

Q. Underwriters Laboratories, Inc. (UL)

UL 510 (2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 910 (NFPA 262 1990) Applicable Flame Test

R. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

3. 5 GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), Project State, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.
B. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.
C. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.
D. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.
E. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.
F. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.
G. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner’s facilities for the disposal of excess or scrap materials.
H. Equipment and materials installed by the Contractor shall be free of defects and damage.
I. Contractor shall be responsible for the repair of any damage caused by the contractor during

the installation.

J. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

K. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Engineer.

L. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

M. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

N. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

O. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

P. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

Q. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

R. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

S. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

T. Contractor shall immediately report to the Engineer any design or installation irregularities, particularly architectural elements that interfere with the intended coverage angles of loudspeakers and projector, so that appropriate action may be taken.

U. Contractor shall observe all HDBaseT Alliance cable types, lengths, bundling, termination, and patching requirements and limitations when installing audio/video over twisted-pair cabling.

V. Contractor shall observe signal separation and signal separation best practices at all times.

W. Any cabling found to be damaged shall be replaced at no cost.

X. Signals shall be separated and grouped according to type and voltage level.

Y. Contractor shall provide all required conduit and sleeves unless otherwise specified. Contractor shall provide conduit bushings even when it is the responsibility of other trades prior to cable installation.

. Contractor shall provide and utilize rear rack rails, lacing bars, and any other required cable dressing equipment/supplies to ensure proper industry-standard signal separation is achieved.

AA. Prior to the commencement of the audiovisual equipment installation as detailed in this document the Contractor shall complete (2) mockup rooms of each system type meeting the requirements of the construction documents. The mockup will consist of (2) reviews to be conducted at different times in the construction process. The first mockup shall be to review conduit pathways for endpoint devices. The second mockup shall be conducted much later in the construction process and will be to review complete system functionality. The mockup rooms shall be selected by the Owner and/or Architect. Full installation of the audiovisual systems as detailed in this document shall not commence until Contractor has received written approval from the Owner and/or Architect. Contractor shall coordinate with the General Contractor, Owner, and the Architect to determine when the mock up rooms will be installed and inspected.

3. 6 AUDIOVISUAL CONTROL SYSTEMS

A. Contractor shall furnish, install and configure a complete audio/video switching, transport and control system as specified and indicated on the technology drawings.

B. Contractor is responsible for all ancillary AV switching or active components necessary to provide a complete and functional AV system.

C. Contractor is responsible for all AV specific cabling, interconnects, patch cords and other ancillary devices required to provide a complete system.
D. Contractor shall coordinate the programming of the touch panels with the Owner/Design Team. Touch panels shall be branded to reflect the colors and logos of the Owner. This coordination may consist of multiple in-person meetings to ensure that the finished product fully meets the Owner's needs and expectations.

Contractor shall fully brief Owner on available configuration settings / options of the program(s).
Contractor shall record the Owner's preferences / decisions and build the initial system program(s).
Contractor shall deliver a written record including (at minimum):
The Owner's preferences / decisions
Contractor's plan for implementation and its methodology.
The final programming / implementation results.
In rooms with motorized projector screens and projectors. Program the system to
When the system is turned 'on' through the control panel the screen shall drop down into place and projector shall turn on simultaneously.
When the system is turned "off" the screen shall retract and the projector will power down.
Audio override through the PA relay control module shall mute the system upon intercom announcement.
Program / adjust the relay to allow the local content to play within 5 seconds of the end of the announcement

E. Once the system programming has been completed and implemented, the Contractor shall allow a minimum 2-month evaluation period for the Owner to use the system and provide feedback.
F. After the evaluation period, the Contractor shall coordinate with the Owner to gain feedback on the system operation. The Contractor shall record the Owner's feedback and provide programming adjustments to resolve any items as directed by the Owner.
G. Contractor shall install the entire control system as specified in accordance with manufactures guidelines and industry best practices.
H. Control processor(s) shall be connected to an un-switched power outlet. Control processor(s) shall be connected to UPS outlet(s) if available.
I. Control system shall be programmed in a manner consistent with current industry best practices.

Control functions shall include (but are not limited to) the following:
System/Device Power On/Off.
Display Source and Sink Switching.
Program Volume Adjustment.
Audio DSP Control.

J. All network-enabled control systems shall be provided with virtual 'soft' control panel client(s)
K. All control system programming shall be delivered to the Owner. The Programmer shall transfer all source code/files related to the system. All programming shall be delivered in both compiled and non-compiled form. Upon system acceptance, ownership of the control programming shall be transferred to the Owner for their future use or modification. No claim shall be made by the programmer for continued licensing or other ongoing fees for continued usage of the control system program.

3. CABLE INSTALLATION

A. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc.
B. All cabling shall be installed per current BICSI standards.
C. When cables leave the main pathway systems, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.
D. No cable pathway shall exceed NEC limited low voltage fill ratios.
E. The contractor shall furnish a separate j-hook or saddle strap pathway for each cable type (data, voice, video and security).

J-hooks and saddle straps shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.
J-hooks shall be furnished with closure clips.
Maximum sag between supports shall not exceed twelve inches (12").

Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no circumstances shall these pathways be used to support other low-voltage applications not included in this specification.
The Contractor shall install no more than (1) hook loop strap between each j-hook or saddle strap or at service loop locations.
No grid wire shall be used for support. J-hooks shall be mounted to the structure or solid support. Solid support is an item that will not move, Examples: all thread supported from structure, walls, structural beams, and ceiling joists.
J-hooks shall not be installed in open ceiling spaces.

F. No nylon cable ties shall be used at any time during the installation of the cable.
G. Signal separation guidelines and best practices shall be observed for the complete length of all cable runs.
H. Above Ceiling-Contractor shall furnish and install plenum-rated hook loop straps in plenum-rated airspaces.
I. Equipment Rooms / Telecommunications Rooms- The Contractor shall bundle all visible cables with Contractor furnished and installed hook loop straps.
J. Hook loop straps shall be installed twenty-four (24) inches apart on center.

3. DEVICE IDENTIFICATION

A. Contractor will permanently affix labels to each cable. Labels will be affixed at a distance of 3” from the end of each cable end. If label cannot be easily viewed from this placement, cable may be placed 1” from the cable end. Cable label shall include unique cable number, source system name, source termination point, and destination system name and destination termination point. Cable labels will be identical on each cable end. Contractor to contact Consultant for additional information, if necessary.
B. Contractor will provide equipment labeling for each device front and back according to the system name used in the shop drawings. Contractor may use laminated labels (white print on black labels in front, black print on yellow in back) or equivalent.
C. Contractor will provide engraved plastic laminate labels for all racks. Rack labels to be 1” x 2” with white lettering (Arial font) on black matte finish, plastic.
D. Contractor will provide all Input/Output (I/O) panels. I/O panels will be produced from black anodized aluminum and engraved with white lettering.
E. For all installed Audiovisual equipment racks Contractor shall provide a 1RU (rack unit) blank with Contractor’s information engraved onto the blank panel. Contractors’ information shall at a minimum include: Contractor name and Warranty contact phone number.

3. 9 ACCEPTANCE REQUIREMENTS

A. Audiovisual System Testing and Configuration
B. Contractor shall un-pack and pre-test equipment prior to installation into the production environment. All configurations shall be re-verified prior to the units being placed into service.
C. Contractor shall test and commission each component per the specifications and manufacture’s installation instructions.
D. Contractor shall test and verify for full operational and network support control functionalities and connections per the specifications and manufacturer’s installation instructions.
E. All network devices shall be verified for link and auto negotiation to the highest connection rate.
F. Audio conferencing systems shall be configured to provide excellent audio performance. Verify POTS or VoIP phone system with Owner/Owner/Consultant prior to ordering and installation. Contractor shall place test calls utilizing the audio-conferencing system to the system manufacturer for system calibration and testing.
G. Video conferencing systems shall be configured to provide excellent audio performance. Contractor shall place test calls utilizing the video conferencing system to the system manufacturer for system calibration and testing.
H. Contractor shall test and verify all functionalities as installed per the specifications and manufacturer’s installation instructions.
I. All Crestron Digitalmedia demonstration and acceptance tests shall be performed by a Crestron Digitalmedia Certified Engineer (DMC-E).
J. Projector(s) shall be installed square in relation to the screen and shall be adjusted to fit and fill

the screen fully. Projector(s) shall be overscanned slightly into the screen border (if applicable). Projected image shall be square and level. Projector(s) shall be installed so that digital keystone correction is not utilized.

K. In situations where keystone correction may be required, notify Owner/Consultant and coordinate solution prior to installation.

L. Projector(s) shall be installed in such a way that the axis of the lens is perpendicular to the plane of the projection surface.

M. In case of mismatch between projector aspect ratio and screen aspect ratio, projector shall be configured to output at screen aspect ratio.

N. In case of mismatch between display device and signal aspect ratio, system shall be configured such that the source image best fits and fills the display device.

O. Unless noted otherwise, all projection screens shall be mounted with the lower edge of the viewable image area at 48” A.F.F.

P. Provide additional projection screen black drop as required.

Q. Video display system(s) minimum test protocols:

Test each video display system with test signal generating equipment capable of outputting the following resolutions. (Ultra HD and 4K resolutions required only when testing 4K systems)
4:3 - 640x480, 800x600, 1024x768
16:9 - 1280x720 (720p), 1366x768, 1600x900, 1920x1080 (1080p), 3840x2160 (Ultra HD), 4096x2160 (DCI 4K).
16:10 - 1280x800, 1440x900, 1680x1050, 1920x1200
Test signal generator must be capable of outputting the correct signal protocol using the applicable connectivity (RCA/BNC, S-Video, VGA, DVI, HDMI, Displayport, Etc.).
The test signal generator must be capable of outputting a standard set of color bars, grid pattern, grayscale, checkerboard and multi-burst.

3.1 TRAINING

A. Contractor shall provide a proposed training schedule to the Owner/Consultant prior to substantial completion.

B. Contractor shall provide a proposed training syllabus for both administrative users and end-users prior to substantial completion.

C. Training shall include all aspects of the Audiovisual System as specified and installed.

D. Provide for (2) hours of training for two (2) persons on each system at the “System Administrator” level covering advanced functions of the system, troubleshooting techniques, etc.

E. Provide for (2) hours of training on each system at the “End User” level covering basic functions and operation of the system.

F. Training shall be conducted on site:

Training shall be scheduled at least 3 weeks prior to students returning to school when possible or no more than 1 to 2 weeks after substantial completion sign off, whichever comes first.
Training schedule shall be coordinated with General Contractor, FBISD Design and Construction PM, and FBISD IT departments to ensure the training is scheduled when the end users are on contract and available.

G. Contractor to provide a test report showing the system has been 100% tested and is 100% operational prior to training.

3.11 CLOSE OUT DOCUMENTATION

A. Contractor shall provide full close out documentation for project including floor plan drawings, product data, signal flow diagrams, point-to-point wiring diagrams, programming documents and files, testing documents, training documents, and all relevant documentation to the project.

B. All revisions from initial bid documents shall be included in the documents including ASI, PR, RFI, and Field condition revisions.

C. Electronic, pdf, as-built drawings will be required for final closeout. Close out drawings must include final installed locations, model numbers, serial numbers, software license keys, MAC addresses, and static IP addresses, all installed equipment, codes, lock and key manufacturer’s codes for duplicates or additional copies, and custom programming. Fort Bend ISD Design and Construction will transmit or share a copy of all electronic as builts, training manuals, and

training videos with FBISD Office of IT.

D. Contractor shall provide a user manual detailing all operations of the installed systems. As part of the user manual Contractor is to provide a recorded video of all functions of all installed systems.
Contractor shall provide basic troubleshooting steps for common issues that may arise for each installed system.

E. Contractor shall provide a quick start guide for all installed systems detailing basic operation of each installed system. The quick start guide shall be on laminated 11”x17” cardstock.

F. Close Out documentation shall be delivered to consultant, owner, and architect no later than (30) days after substantial completion unless otherwise noted.

END OF SECTION 27 4116

SECTION 2 51 - PUBLIC ADDRESS AND IRELESS CLOC SYSTEM

PART 1 – GENERAL

1.1 This section identifies the requirements, technical design, and specifications for the distributed audio communication systems Fort Bend ISD Marshall High School, located in Missouri City, Texas (“Owner”). The Distributed Audio System as specified is an Industry-Standard and include 2-way intercom and 1-way paging/public address system.

1.2 The existing Telecor XL building intercom system will be expanded to accommodate the new devices.

The Contractor shall provide a Manufacturer’s Performance Certification for the installed audio system.

1.3 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional audio system regardless of any items not listed or described in this specification or associated drawings.

1.4 It is strongly recommended that each prospective Contractor perform a site visit to determine any site conditions that may impact the installed system cost prior to submitting a bid. Failure to perform a site visit does not release the Contractor from responsibility for any existing conditions.

1.5 REQUIREMENTS

A. Contractor Experience Requirements

B. Submittal Requirements

C. Acceptable Manufacturers

D. Codes, Standards and Regulations

E. General Requirements

F. System Requirements

G. Testing Requirements

H. Project Closeout Documentation

I. Attachments

1.6 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27 and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. Submitting contractor must be a Telecor Certified Dealer with full warranty privileges prior to submitting a proposal.

2. The Telecor Authorized Integrator must have installed a minimum of 5 (five) projects of this size and application or shall arrange for onsite factory assistance during system commissioning.

3. The Contractor's Project Manager shall be available for all onsite coordination meetings.

4. The Contractor shall have been in business for a minimum of five (5) years.

5. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

6. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

7. Certification shall be submitted verifying the Contractor is the manufacturer's authorized Contractor.

8. Certificates of attendance will be submitted for attendance in manufacturer's installation / maintenance training by the Contractor's directly employed personnel.

9. Provide 24-hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours.

C. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1. SUBMITTAL REQUIREMENTS

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.

2. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e. product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

3. Manufacturer product data sheets for each proposed system component.

   a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.

4. Manufacturer Product Certifications for Company.

5. Manufacturer Product Certifications for Installers.

6. Manufacturer Certifications for testing equipment technicians.

7. Manufacturer Certifications for testing equipment calibration.

8. Manufacturer Certifications for Contractor's Project Manager and available for all onsite coordination meetings.

9. Manufacturer Warranty letter.

10. Documentation indicating that Contractor has been in business for (5) years.

11. Address of Contractor's local office within a 75-mile radius of the project site.

12. Quantity of full-time local technicians within a 75-mile radius of the project site.

13. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

14. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

15. Shop drawings of the proposed system installation.

    a. Shop drawings shall include speaker locations, gateway locations and mounting method, cabling diagrams, outlet locations, preliminary cable numbers, proposed cable pathways, system schematics, and riser diagrams. Shop drawings shall be submitted on 30" X 42" bond paper.

    b. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Design Consultant.

16. Itemized list of all equipment, materials and labor required for the installation of the audio system as specified herein.

    a. This list shall be provided in printed and electronic format (Microsoft Excel) and shall contain: Part Number, Description, Unit of Measure, Unit Cost, Quantity, Labor Cost and Extended Cost to provide a complete and functional audio-visual system.

B. Project Closeout Submittal

1. The Contractor shall provide three (3) sets of comprehensive drawings accurately depicting the "as-built" condition Public Address and Clock Systems as they were installed to the Owner/Consultant at the time of substantial completion. Final payment will not be made until these as-built documents are received and approved by the Owner/Consultant.

    a. As-built drawings must be provided in original hardcopy format and on a CD-ROM and/or delivered electronically in AutoCAD rel. 2010 or higher.

2. Documentation shall include but not be limited to:

    a. Equipment O M manuals

    b. Installed equipment list (manufacturer model numbers, serial numbers, installed locations, etc.)

c. Configuration information in Microsoft Excel format (IP addresses, Passwords and Usernames etc.)

d. Warranty support information

e. Documentation shall be bound, sectioned and tabbed in the following order (when applicable):

1) Equipment O M Manuals (Bound Separately)

2) Installed Equipment List

3) Configuration Information

4) Warranty Support Information

3. The Contractor shall provide three (3) sets of test documentation for the Public Address and Clock Systems to the Architect/Design Consultant at the time of final systems acceptance. Test results shall be provided in original hardcopy format and on a CD-ROM. Final payment will not be made until these test results are received and approved by the Architect/Design Consultant.

4. The Contractor shall furnish the original Certificate of Warranty to the Architect/Design Consultant at the time of final systems acceptance. Final payment will not be made until this Certificate of Warranty is received and approved by the Architect/Design Consultant.

C. Contractor shall provide warranty information to include the name, address and phone number contacts for warranty call outs. Final payment will not be made until this warranty information is received and approved by the Architect/Design Consultant

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Design Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Design Consultant which certifies performance characteristics and compliance with industry standards.

2.2 Acceptable Manufacturers

A. Public Address System

1. The following equipment shall be used as a basis of design for the Public Address System. Equivalent systems and/or components from the manufacturers Rauland, Bogen and TeleCor are also acceptable.
   a. Provide 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.

B. Public Address System Cabinet

1. Telecor XL Card Cage Unit
   a. CCU-XL

2. Telecor XL Central Processing Unit
   a. CPU-3-XL-MA

3. Telecor XL Audio Buffer Unit
   a. ABU-3A-MA

4. Telecor XL Console Port

a. CCP-300-MA

5. Telecor XL Power Supply Unit
   a. PSU-2

6. Telecor XL Audio Termination Panel
   a. ATP-AX2

C. Power Amplifiers

1. Telecor XL - Tel 60
2. Telecor XL - Tel 125
3. Telecor XL - Tel 250

D. Speaker Input/Output Board

1. Telecor XL – IOP-2

E. Telephone Integration Board

1. Telecor XL - PBI-6-MA

F. Serial Connection Board

1. Telecor XL RS232 – Data I/O Board

G. Administrative Control Console

1. Telecor XL MCC-300

H. Administrative Console Program Source:

1. Tascam CD-200IL

I. Wall Jack for Master Control Console

1. Standard telephone line cord and wall jack

J. Remote Clock Driver

1. Telecor XL RCD-7-XL-MA

K. Administrative Paging Microphone

1. TOA – PM660U

L. Attenuators

1. Atlas – AT- 35 (Private Offices)
2. J.W. Davis Brand – AT-40S (Remote Volume Control)

M. Call Switches (provide 1 call switch in each classroom)

1. Telecor – CS-1

   a. .

2. 66 Block – Siemens Model *Determined by Contractor*

a. Provide 66 style punch-down blocks (matching existing equipment) to support the number of stations in the expansion required.

b. Provide 25 pair cabling with Amphenol connectors to support the number of stations in the expansion required.

3. Cable Management

a. Rear Rack Rails

1) Provide and install compatible Middle Atlantic rear rack rails for the existing rack/cabinet that houses the PA headend equipment.

b. Cable Lacing Bars

1) Provide and install compatible Middle Atlantic cable lacing bars to secure the existing and new 25-Pair cables.

2) One lacing bar shall be installed behind each termination card.

3) Existing cabling shall not be disconnected from head end cards

4) 25-Pair cables shall be fastened to lacing bars around entire 25-Pair cable jacketed assembly. Do not fasten individual wires/pairs to lacing bars.

N. Paging/Intercom Call Button:

1. Call Station (QTY PER PLAN)

a. Approved Equivalent.

O. Loudspeakers:

1. Quam –
a. Classrooms and instructional spaces - System12/VC (Lay in ceilings)

b. Administrative offices and conference rooms – System12

2. Atlas APF-15T (Interior/Exterior - Recessed)
a. Include the following:

1) Atlas 161RES Recessed Backbox

2) VP161A-APF

3. Toa PE-304 (Open Ceilings)

4. Liberty 4-Conductor, Plenum-Rated, Shielded Cable – Part Number 22-4C-PSH

5. Or Equivalent

P. Pathway Wire Support

1. Panduit J-Mod Cable Support System

2. Erico – CADDY CAT LINKS J-Hook Series

3. Panduit Plenum Rated Hook Loop (Black)

Q. Clock System
1. The following equipment shall be used as a basis of design for the clock system. Equivalent systems and/or components from the manufacturers Sapling and Bogen are also acceptable.
a. System Controller SSIQ 5w 6 Signal Ethernet – American Time Model SSQMSTR-05N6E
b. Clock Ssiq 12" Round Ddw Black Battery Ch 4 Battery Booster – American Time Model SQ93BADD204BP
c. Clock Digital Ssiq 4" Red 4 Digit Surface Black 120v 3 Prong Plug – American Time

R.

PART 3 – EXECUTION

3.1 CODES STANDARDS REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 Standard Specification for Hard-Drawn Copper Wire
2. ASTM B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
4. ASTM D 709 Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 15th Edition
2. Outside Plant Design Reference Manual 6th Edition
3. ANSI/BICSI 002, Data Center Design and Implementation Best Practices
4. NECA/BICSI 568 – Standard for Installing Commercial Building Telecommunications Cabling
5. NECA/BICSI 607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Electronics Industry Alliance (EIA)

F. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits,
2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network,
3. FCC Part 76, Cable Television Service,

G. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640 Fiber Optic Outside Plant Communications Cable
2. ICEA S-98-688 Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
3. ICEA S-99-689 Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

H. International Electrotechnical Commission (IEC)

I. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. IEEE Standard 81, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
2. IEEE Standard 1100, Recommended for practice for Powering and Grounding Sensitive
3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
4. IEEE C2 National Electrical Safety Code
5. IEEE Std 100 The Authoritative Dictionary of IEEE Standards Terms

J. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises
3. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration
4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises
5. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration

K. National Cable Television Association (NCTA)

L. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code
2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
3. NFPA-101, Life Safety Code
4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)

O. Occupational Safety and Health Administration (OSHA)

P. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA -568.0-D.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
4. ANSI/TIA-568.3-D-1, Optical Fiber Cabling Components Standard.

5. ANSI/TIA–569-E Commercial Building Standard for Telecommunications Pathways and Spaces.

6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure.

7. ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

8. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

Q. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction

2. RUS Bull 1751F-643 Underground Plant Design

3. RUS Bull 1751F-815 Electrical Protection of Outside Plant

4. RUS Bull 1753F-201 Acceptance Tests of Telecommunications Plant (PC-4)

5. RUS Bull 1753F-401 Splicing Copper and Fiber Optic Cables (PC-2)

6. RUS Bull 345-65 Shield Bonding Connectors (PE-65)

7. RUS Bull 345-72 Filled Splice Closures (PE-74)

8. RUS Bull 345-83 Gas Tube Surge Arrestors (PE-80)

R. Underwriters Laboratories, Inc. (UL)

1. UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

2. UL 910 Applicable Flame Test

3.2 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Design Consultant in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Design Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

3.3 GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Design Consultant for direction before proceeding with that part of the work.

B. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

C. The Contractor shall install the materials in accordance with these specification and the manufacturer’s installation guidelines.

D. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

F. Contractor shall notify the Architect/Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

G. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

H. Equipment and materials installed by the Contractor shall be free of defects and damage.

I. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

J. Contractor shall test all equipment prior to installation. By failing to perform this testing operation, the Contractor shall accept the equipment as compliant and assume all liability for the replacement of equipment at no cost to the Owner should it be found defective at a later date.

K. Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Design Consultant.

L. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

M. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

N. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Design Consultant.

O. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

P. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

Q. Contractor shall be responsible to properly protect equipment from damage by other trades during construction.

R. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

S. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.4 SYSTEM REQUIREMENTS

A. Quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a complete and functioning system. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity shall be furnished.

B. Networked Controller:

1. Contractor shall furnish and install the networked controller(s) as indicated on the technology drawings and associated equipment schedules and diagrams.

2. Contractor shall provide installation in accordance with Manufacturer's installation instructions.

3. Contractor shall coordinate exact location/placement to ensure all spaces are coordinated with other trades sharing the spaces.

4. Contractor shall load the latest firmware updates on all equipment and components.

5. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.

6. Contractor shall work with the district to implement the proper bell schedule for the facility.

7. Contractor shall work with the owner to ensure each piece is properly configured and fully operational. Upon completion, the equipment shall be clean and left in perfect operating condition.

C. Switching Security Card(s)

1. Contractor shall furnish and install the switching security card(s) as indicated on the technology drawings and associated equipment schedules and diagrams.

2. Contractor shall provide installation in accordance with Manufacturer's installation instructions.

3. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.

4. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.

D. Wall-Mounted Shelf:

1. Contractor shall furnish and install the shelf as indicated on the technology drawings and associated equipment schedules and diagrams.

2. Contractor shall provide installation in accordance with Manufacturer's installation instructions.

3. Upon completion the contractor shall ensure the equipment is clean, level, properly anchored and left in perfect operating condition.

E. UPS / Battery Backup for Paging System:

1. Contractor shall furnish and install the UPS as indicated on the technology drawings and associated equipment schedules and diagrams.

2. Contractor shall provide installation in accordance with Manufacturer's installation instructions.

3. Contractor shall load the latest firmware updates on all equipment and components.

4. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.

5. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.

F. Intercom Call Button (2-way locations):

1. Contractor shall furnish and install the call button(s) as indicated on the technology drawings, and associated equipment schedules and diagrams.

2. Contractor shall furnish installation in accordance with Manufacturer's installation instructions.

3. Contractor shall energize and commission equipment in accordance with manufacturer instructions.

4. Contractor shall provide final adjustments to the system. Upon completion, the system shall be clean, adjusted and left in perfect operating condition.

G. Loudspeakers

1. Contractor shall furnish and install the loudspeakers as indicated on the technology drawings, and associated equipment schedules and diagrams.

   a. Drop-Tile, Ceiling-Mounted talkback Paging Loudspeaker (Typical Classrooms):

   b. Drop-Tile, Ceiling-Mounted Paging Loudspeaker (Typical Offices/Hallway/Etc.):

   c. Surface-Mounted Paging Loudspeaker – Indoor (Locations Without Accessible Ceiling):

   d. Surface-Mounted Horn Paging Loudspeaker – Outdoor:

2. Contractor shall furnish installation in accordance with Manufacturer's installation instructions.

3. Contractor shall energize and commission equipment in accordance with manufacturer instructions.

4. Contractor shall work with the owner to ensure each speaker is properly configured and fully operational.

5. Contractor shall adjust the volume levels on each speaker to the satisfaction of the Owner.

6. Upon completion, the equipment shall be clean and left in perfect operating condition

H. Bridges / Backboxes and Cages

1. Contractor shall furnish and install bridges and backboxes in all drop-tile locations as indicated on the technology drawings.

2. Contractor shall furnish and install cages on wall speakers in areas where damage is likely (such as gymnasiums) as indicated on the technology drawings.

3. Contractor shall furnish installation in accordance with Manufacturer's installation instructions.

4. Upon completion, the equipment shall be clean and left in perfect operating condition

I. Paging System Cabling

1. Contractor shall furnish and install the cabling as indicated on the technology drawings, and associated equipment schedules and diagrams.

2. Contractor shall furnish installation in accordance with Manufacturer's installation instructions.

3. Contractor shall energize and commission equipment in accordance with manufacturer instructions.

4. Contractor shall provide final adjustments to the system. Upon completion, the system shall be clean, adjusted and left in perfect operating condition.

J. Administrative Handsets

1. Each dialing administrative telephone in the system shall be programmable for the following options:
   a. Allow zone paging
   b. Allow paging of individual rooms
   c. Allow All-Page announcements
   d. Allow Executive Override
   e. Allow Emergency Paging
   f. All activation of Time one tones
   g. Set the priority level and target display or "normal" calls
   h. Set the priority level and target display of "emergency" calls
   i. Assignment of architectural number
   j. Class of service
   k. Assignment of associated speaker to paging zone
   l. Automatic Call-Back Busy
   m. Call Forward-No Answer
   n. Call Forward-Busy

K. oning

1. oning shall be coordinated with The Owner. Additional and separate paging zones shall be provided, and each location shall be programmed in software to belong to any combination of software zones. Initially zones shall be provided for the following:
   a. general corridors
   b. all call
   c. exterior speaker
   d. individual classrooms

2. PA is programmed so that it can page individual rooms in the building as well as page by zones. Provide 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.

L. Public Address System Integration with Classroom Audio Visual Systems

1. Classroom Audio Visual systems shall be installed and configured to mute program audio during paging events. This functionality requires coordination between the Public Address System Contractor (275100) and the Audio-Visual Systems Contractor (274100).
2. The Public Address System Contractor shall provide and install cabling from the classroom Public Address speaker to the equipment enclosure/amplifier location. This cable shall be terminated and connected to the AV system by the Audio-Visual Systems Contractor. The Public Address System Contractor shall work with the Audio-Visual systems Contractor to ensure that the interconnection and associated functionality are fully tested and operational.

M. Public Address System Integration with Classroom

1. The Public Address System Contractor shall provide and install cabling from the classroom Public Address speaker to the equipment enclosure/amplifier location. The Public Address System Contractor shall coordinate with FBISD to ensure that the interconnection and associated functionality are fully tested and operational
2. Provide 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.
3. Provide activation of security monitoring functions on a per room basis and per zone basis. Amplified two-way voice communications shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is open and a supervisory tone shall sound at regular intervals when speaker monitoring is active.

N. Public Address System Integration with Phone System

1. Provide a programmable and addressable system to every occupied space and to the exterior of the building.
2. Provide 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.
3. Provide activation of security monitoring functions on a per room basis and per zone basis. Amplified two-way voice communications shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is open and a supervisory tone shall sound at regular intervals when speaker monitoring is active.
4. The public address system shall provide for bell changes and shall be capable of storing events, schedules, programmable holidays, bells silenced, etc.
5. Provide for integration with the synchronized wireless clock system.
6. Provide for integration with the audio | visual systems allowing for “Priority Page Override” capability.

7. Provide data network cables as required for network connectivity.
   a. Installed per DIV. 27 cabling specifications.
8. The public address system shall be provided with a UPS with a (60) minute capacity.
9. The public address system shall be connected to the emergency generator, when available.
10. The public address system must integrate with the The Owner Cisco VoIP phone system.
    a. An FXO interface will not be accepted.
    b. A SIP interface the public address system manufacturer certifies will work with the Cisco Call Manager 12.0 is preferred. If a SIP interface is not available, provide a Viking RAD-1A, a Cisco ATA190 and an analog phone for testing.
       1) The Owner will configure the ATA190 on the Cisco Call Manager.
       2) The Contractor will configure the Viking RAD-1A and make the interconnection between the network switch, Cisco ATA190, Viking RAD-1A and Public Address System.
11. Provide for the increase of stations by 25 percent above those required for the initial design without adding any internal or external components.
12. The existing public address system shall be located inside MDF Room A114 and any mechanical rooms for an intermittent cross connection. Contactor shall coordinate with Architect/owner and Design Consultant for any mechanical rooms for an intermittent cross connection. All wall mounted equipment shall be mounted on fire rated plywood with dedicated electrical receptacles located next to the panels on the fire rated plywood.

O. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.

2. When cables leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.

3. No cable pathway shall exceed 40% fill ratio.

4. The contractor shall furnish a separate j-hook or saddle strap pathway for each cable type (data, voice, video and security).

5. J-hooks and saddle straps shall be installed no more than five-feet (5’) apart on center, using only manufacturer-approved installation methods and hardware.

6. J-hooks shall be furnished with closure clips.

7. Maximum sag between supports shall not exceed twelve-inches (12”).

8. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.

9. Cable Dressing

   a. No nylon cable ties shall be used at any time during the installation of the cable.

   b. Above Ceiling

      1) Contractor shall furnish and install plenum-rated hook loop straps in plenum-rated airspaces.

a) The Contractor shall install no more than (1) hook loop strap between each j-hook or saddle strap or at service loop locations.

c. Equipment Rooms / Telecommunications Rooms

1) The Contractor shall bundle all visible cables with Contractor furnished and installed hook loop straps.

a) Hook loop straps shall be installed twenty-four (24) inches apart on center.

3.5 Training

A. Distributed Audio Communication Systems Training

1. Contractor shall provide a proposed training schedule to the Architect/Design Consultant prior to substantial completion.

2. Contractor shall provide a proposed training syllabus for both administrative users and end-users prior to substantial completion.

3. Training shall include all aspects of the Audio/Visual System as specified and installed. Contractor shall include provisions within the total cost proposal for a minimum of one (1) System Administrator training session. It is anticipated this training will cover advanced functions of the system, basic trouble-shooting techniques and other subject matter pertinent to the on-going support of the A/V systems at the installed facility including bell schedule.

4. Contractor shall include provisions with the total cost proposal for a minimum of two (2) End-User training sessions. It is anticipate this training will cover basic function and operation of the system by faculty. This would include event display management, source control and general systems operation for all installed systems.

3.6 Testing Requirements

A. Distributed Audio Communication Systems Testing

1. Contractor shall un-pack and pre-test equipment prior to installation into the production environment. All configurations shall be re-verified prior to the units being placed into service.

2. Contractor shall test and commission each component per the specifications and manufacture’s installation instructions.

3. Contractor shall test and verify for full operational and network support control functionalities and connections per the specifications and manufacturer’s installation instructions.

4. All network devices shall be verified for link and auto negotiation to the highest connection rate.

5. Contractor shall test and verify all audio functionalities as installed per the specifications and manufacturer’s installation instructions.

6. Contractor shall test and verify all audio functionalities of existing audio equipment for functionality.

7. Bell schedule to comply with district's bell schedule.

3. Project Closeout Documentation

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.

2. Three (3) sets of drawings depicting the condition of the audio-visual system as installed.

3. As-Built drawings shall be produced in AutoCAD 2010 or higher and provided in hardcopy and electronically in .dwg and PDF format.

4. Hardcopy drawings shall be provided in the original size as issued by the Architect/Design Consultant.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.

6. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all projectors, projector mounts, projection screens, wall elevations, cable tray, sleeves, pathways, workstation locations, and labeling scheme.

B. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

3. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and

END OF SECTION 2 51

SECTION 28 02 00 - BASIC MATERIALS AND METHODS FOR SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect and Engineer for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect and Engineer.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all labor, material, tools, equipment and services necessary and required to form the complete and functioning electronic safety and security systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Security items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning Safety and Security system shall be considered a part of the overall "Scope".

H. Coordinate with other contractors on items required for the proper functioning of Safety Security system and indicated as provided by others, such as power, backboxes, conduits, sleeves, air conditioning, structural support, etc..

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.3 RELATED SECTIONS

A. Div 1 and conditions of the contract

B. Section 08 71 00 - Door Hardware

C. DIv 26 Electrical

D. Div 27 Communications

1.4 REFERENCES

A. Americans with Disabilities Act (ADA)

B. Building Codes (UBC) (IBC), latest editions

C. National Electrical Code (NEC)

D. American Society for Testing and Materials (ASTM)

E. Underwriter's Laboratories, Inc. (UL)

F. Insulated Cable Engineer's Association (ICEA).

G. National Electrical Manufacturer's Association (NEMA).

H. Institute of Electrical and Electronics Engineers (IEEE).

I. American National Standards Institute (ANSI).

J. National Fire Protection Association (NFPA).

K. International Energy Conservation Code (IECC).

L. BICSI (Building Industry Consulting Services International)

M. Owner’s Design Guidelines and Construction Standards

N. Local, county, state and federal regulations and codes in effect as of date of installation.

1.5 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of Security devices, equipment cabinets, conduits and sleeves, etc. are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such items and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
2. Communicate with the Architect and secure his approval of any location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of ceiling devices shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical, electrical, plumbing contractor may be required to allow adequate clearances for all building components. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.6 DESCRIPTION OF SYSTEM WORK

A. Furnish and install all materials, tools, equipment, and services for all electronic security/surveillance devices to provide functioning systems in accordance with performance requirements specified and any modifications resulting from reviewed shop and field coordinated drawings.
   1. Access Control System
      a. This system replaces the typical mechanical key-controlled door lock with a door locking system that uses an access card as the access credential.
      b. The system includes an electric door-locking mechanisms, card reader located adjacent the door, door status sensor, door prop alarm and a request to exit device.
      c. Typical system configuration is card or schedule-controlled entry with free exiting.
   2. Intrusion Detection System
      a. This system monitors areas for unauthorized entrance or intruder.
      b. This system can consist of motion sensors, door status sensors, glass break sensors and one or more control keypads.
      c. The keypad is used to arm/disarm system by entering a numeric code on the keypad.
   3. Video Surveillance System
      a. This system is used to provide video surveillance through the use of cameras of security sensitive areas and target items.
      b. The system shall allow for the viewing and recording of images.

B. RACKS AND ENCLOSURES
   1. Wall mounted enclosures, data gathering panels, and power supply panels shall be installed as per manufacturer’s requirements.
      a. Coordinate pathways and power with Electrical and Telecommunications Contractors
      b. Furnish all labor, materials, tools, equipment, and services for all control consoles, equipment racks, cabinets, and enclosures not provided by others in accordance with contract documents.
      c. Completely coordinate with work of other trades to avoid duplication in purchasing.
      d. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, and devices incidental to or necessary for a sound, secure and complete installation.
   2. Coordinate with rack/cabinet provider if it’s indicated to be provided by others. Include them in scope of work if no other contractor is available or no indication that it is to be provided by others.

a. Coordinate with G.C.

3. The designated security space will provide an area reserved for rack and wall mounted security equipment.
   a. The rack area allows for vertical relay rack(s).
   b. Backboard wall area of 8’-0” X 8’-0” shall be reserved for wall-mounted components.
4. Provide all supplementary or miscellaneous items and devices incidental to or necessary for a sound and complete installation.
5. Drawings are representative and show general arrangement of systems and equipment, except when dimensioned or detailed.
   a. For exact locations refer to dimensioned architectural drawings.
      1) Field measurements take precedence over dimensioned drawings.
      2) Field verify locations and arrangement of all systems and equipment.
      3) Coordinate all work with other trades and Contractor.
6. Circuit Supervision
   a. Supervise all signal and data transmission lines, links with other systems, and sensors.
      1) Indicate circuit and detection device faults with both protected zone and trouble signals.
      2) Initiate an alarm in response to opening, closing, or shorting of a signal or data transmission line.
7. Electronic Safety and Security work as specified in this Section and sub sections shall include but not limited to:
   a. A project kick-off/pre-submittal meeting with the Architect, Designer, and Contractor to review security design package.
      1) Additional participants shall include:
         a) Division 8 subcontractors
         b) Division 26 subcontractors
   b. Preparation of pre-installation submittals, including point-to-point wiring information for security equipment to interface to work by others prior to start of any installation work. Include lock permit requests in submittals for review.
   c. Furnishing and installation of all devices, components and accessories.
   d. The furnishing and coordination on installation of special back boxes for equipment and field devices as required.
   e. Furnishing, installation and termination of all wiring and cabling including any special purpose wire and cable for electronic safety and security systems.
      1) Coordinate all phone, network and fiber optic cable interface provided by telecommunications subcontractor or carriers.
   f. Coordinate raceway and power distribution systems provided by Division 26.
   g. Provide and install 12/24 VAC/DC input power to all field devices as required.
   h. Coordination with other trades and Owner required to facilitate the installation of the safety and security equipment including:
      1) Division 08 (doors)
      2) Division 26 (power, raceways, and fire alarms)
      3) Division 27 (telecommunications network interface).
   i. Wiring and termination of electrified door hardware by security subcontractor shall be concurrent with the installation of these electrified components by the door hardware subcontractor.

j. Programming of all security control equipment and prior coordination with the Owner's security and telecommunications personnel, unless noted otherwise.

k. Preparation of "As-Built" documentation.

l. Warranty service for completed work.

1.7 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.8 QUALITY ASSURANCE

A. Contractor shall have a complete working knowledge of the Security system being installed.

B. Maintain a valid Type B license from the Texas Private Security Bureau.

C. Contractor shall have installed similar-sized systems in at least ten (10) other projects in the last five (5) years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document and maintain manufacturer certification for the system to be installed.

D. The security integrator must maintain an operating facility in the local area (50 mile radius) of the Project location to provide service to the Owner for the warranty period.
   1. At the Owners request for service, the security integrator shall dispatch a service technician to the location to affect the required repairs or adjustments.

E. The contractor shall maintain a spare parts inventory necessary to resolve component failures of the system.
   1. Refer to individual specification section for a list of specifically required parts provided to the owner and stored on site. These parts will become the property of the owner.
   2. At the end of the warranty period the Safety and Security integrator shall test the owner's spare parts and repair or replace as needed to bring the parts up to proper operation.

F. Contractor shall obtain Safety and Security system product manufacturer's certification if applicable.

G. Refer to General Conditions for other requirements.

1.9 CONTRACTOR REQUIREMENTS

A. In order to accomplish the conditions of this agreement, the Contractor shall perform the specific duties listed herein.

B. Contractor shall provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services to provide and install a complete Safety and system. Pay all required sales, gross receipts, and other taxes.

C. Insurance
   1. The Contractor shall procure, submit for review, and maintain for the duration of this agreement, insurance against claims for injuries to persons or damages to property which may arise from, or in connection with, the performance of work hereunder by the Contractor, his agents, representatives, employees or subcontractor. The Contractor shall pay the cost of such insurance.
   2. The Owner, its directors, officers, representatives, agents and employees, respectively, shall have no responsibility to the Contractor with respect to any insurance in accordance with the provisions set forth herein.

D. Regulatory Requirements
   1. Safety and Security Contractor shall supply all city, county, and state telecommunication cabling permits required by Authority Having Jurisdiction (AHJ).
   2. Safety and Security Contractor shall be licensed and/or bonded as required for Safety and Security systems.

E. Privacy and Confidentiality
   1. The Contractor will respect and protect the privacy and confidentiality of Owner, its employees, processes, products, and intellectual property to extent necessary, consistent with the legal responsibilities of the Owner policies.
   2. Contractors shall sign a non-disclosure agreement and abide by the requirements to keep confidential all information concerning bid documents and this project.

F. Use of Subcontractors
   1. Successful bidder shall inform the Owner's contact and General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired.
   2. The Owner or Owner's designated contact must approve the use of Subcontractors in writing prior to the Subcontractor's hiring and start of any work.

G. The Contractor's designated Project Manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications, references, and drawings) to ensure a quality installation and attend project meetings with the telecommunication consultant, the Owner and others.

H. Coordination
   1. Coordinate installation work with other trades (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) to resolve procedures and installation placement for cable trays and cable bundle pathways.
   2. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for Safety and Security components.
   3. Exchange information and agree on details of equipment arrangements and installation interfaces.
   4. Coordinate with electrical contractors and plan for the pathway routes used Safety and Security cabling to minimize cable lengths.
   5. Record agreements with other trades and distribute record to other participants, Owner and telecommunication consultant.

1.10 GENERAL REQUIREMENTS

A. Upon completion of commissioning testing and Owner acceptance, DBR bears no liability or responsibility for the continued proper operation of the installed systems.

B. The Items described herein shall not be modified or substituted without consent of DBR and/or the Owner.

C. Electronic Safety and Security systems integrator (Safety and Security subcontractor) manager/supervisor shall attend meetings arranged by the Contractor, Architect, Owner or other parties affected by the work of this Section.

D. If the manufacturer of Safety and Security devices or connecting hardware has supplied post manufacture performance data, copies of such are to be kept for inclusion in the documentation and made available to the Owner upon request.

E. All materials are to be new unused and of the latest series of model number, unless otherwise indicated by the Owner or Safety and Security system designer.

F. All Safety and Security integrator personnel must be manufacturer certified and capable of an installation that falls under the manufacturer's guidelines necessary to obtain a manufacturer warranty.
   1. The integrator shall provide all components/materials essential for a complete and functional Safety and Security access and surveillance system.

G. Safety and Security integrator shall issue a 2-year warranty on installation and workmanship.

H. These Specifications and Drawings are intended for bidding purposes only; no part shall be copied or used for any purpose other than bidding on this project.
   1. This package shall be contractual upon bid award.

I. Drawings and Specifications are to be used in conjunction with one another and to supplement one another.
   1. In general Specifications determine the nature and quality of the materials and tests, and drawings establish the quantities, details and give characteristics of performance that should be adhered to in the installation of the Safety and Security system components.
   2. If there is an apparent conflict between the drawings and specifications, or within the specifications themselves, the items with greater quantity or quality shall be estimated and installed.
   3. Clarification with the Owner/Designer about these items shall be made prior to purchase and installation.
   4. Questions regarding the Specification or system requirements should be directed in writing to DBR or the Owner.

J. Safety and Security integrator shall adhere to Division 1 general requirements and written Safety and Security Specifications and Drawings within this construction package and shall be responsible for complying with all local, state and federal laws or regulations applicable to the work being performed, even though said law, rule or regulation is not identified herein.

K. Safety and Security integrator shall arrange and pay for any inspections required by the public agencies having jurisdiction in the area.

L. The Safety and Security contractor shall procure and maintain for the duration of this agreement, insurance against claims for injuries to persons or damages to property which may arise from, or conjunction with, the performance of the work hereunder by the Safety and Security integrator, his agents, representatives, or employees.
   1. The Safety and Security integrator shall pay the cost of such insurance.

M. The Safety and Security integrator will respect and protect the privacy and confidentiality of the Owner, his employees, processes, products, and intellectual property to the extent necessary, consistent with the legal responsibilities of the State of Texas and the Owner.

N. If required the Safety and Security integrator shall sign a non-disclosure agreement and abide by its requirements to keep confidential all information concerning bid documents and this Project.

O. Furnish submittals and manuals in accordance with Division 1.

P. Furnish a detailed material list complete with suppliers (distributors) list of components and distributors name, address, and phone number.

Q. Refer to Specifications issued by Architect, Division 1, for Project and cost payments.

1.11 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.12 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.14 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
   2. An index page with a listing of all data included in the Submittal.
   3. Product Data and Shop Drawings shall be submitted in separate submittals, to avoid rejection of one due to errors in the other.

B. Shop Drawings
   1. Safety and Security Contractor shall submit, for approval, floor plans that identify all device locations, device ID, cable routes and quantities, cable types, riser locations, and references to installation details and diagrams.
   2. A functional description of each system.
   3. All cable and wiring types for each device type used.
   4. Certification that lock wiring and access control systems requirements have been coordinated with electrified door hardware, fire alarm systems, automatic door controls, and overhead door controls specified in other sections and other packages.
   5. Riser diagram showing routes between floors or other areas that are not easily identified on the floor plans.
   6. Safety and Security One-line diagrams showing all input and output points of the system.
      a. The Contractor shall make any corrections required by the consultant team, file with him two corrected copies and furnish such other copies as may be needed.
   7. Power supply points listing with devices and maximum loads to prevent overloading.
   8. Equipment schedules listing all system components, manufacturer, model number and quantities of each.
   9. Safety and Security Contractor shall submit, for approval, diagrams that show Safety and Security equipment layouts, rack layouts (including wall and rack elevations), cabling riser and interconnection diagrams, etc.
   10. Safety and Security Contractor shall submit, for approval, labelling scheme for all Safety and Security devices and cabling components (faceplates, horizontal cables, riser cables, inter-building cables, racks, patch panels, etc.) installed.
   11. The Contractor shall make any corrections as required by the Engineer and submit revised shop drawings to the team for approval.
   12. Approval by the Engineer of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules. Requests to deviate shall be submitted in writing to the Architect.
   13. Drawings shall show the proposed firestop systems and locations, (stamped/embossed by the PE) to restore/maintain the designed fire rating of the building structure (walls, ceilings, floors, etc.).
   14. Shop Drawings shall be newly prepared and not reproduced from the Contract Documents. Drawings shall be prepared by a draftsman skilled in this type of work. Submitting copy of the engineering drawings or engineering drawings with contractor's markup as shop drawings is NOT ACCEPTABLE.
   15. Shop drawings shall be developed in coordination with other trades (MEP, Architecture, Structural, etc.) to avoid any collision or conflict and to meet all industry standards best practices, codes and regulation requirements. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified
   16. Additional coordination with other trade contractors may be required to allow adequate clearances and meet code requirements. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner

C. Product Data Submittals
   1. Safety and Security Contractor shall submit catalogue cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten and/or highlighted to indicate exact selection.
   2. Safety and Security Contractor shall identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.

3. Inlcude battery backup calculations to show load and back-up times for UPS and power supplies with batteries.
4. Include licenses and permit required, and qualifications and proof of work history (with references).
5. All data sheets shall be organized by specification sections and provided with table of contents. All products required shall be included in one submittal.
6. All product substitutions shall be submitted in advance for review and approval before being included in product submittal package.
7. Specification variations pages with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then the specification page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
8. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
9. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
10. Identification of each item of material or equipment matching that indicated on the Drawings.
11. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
12. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT”.

D. Warranty
1. The Safety and Security Contractor shall submit appropriate documentation from the certifying manufacturer showing the project is registered and qualified for the System Assurance Warranty.
2. All subsequent work shall be in accordance with approved submittals. The Safety and Security Contractor shall not perform any portion of the work requiring approval of the System Assurance Warranty manufacturer’s warranty registration qualification procedures that would disqualify any part or all of the system from that warranty qualification.

E. Qualifications
1. Safety and Security Contractor shall submit a list of the Contractor’s previous projects that demonstrate qualification for this project. This list shall include, but not be limited to:
    a. At least ten (10) other projects in the last five (5) years
    b. Name and location of project
    c. Project contacts, email addresses, and phone numbers
    d. Total square footage
    e. Total number of devices
    f. Types of system platform

2. Safety and Security Contractor shall submit an up-to-date and valid statement of qualifications for those assigned to perform the work specified herein at time of bid submission.
    a. Safety and Security Contractor Employees
    b. Subcontractors
3. Manufacturer certifications for Contractor and installers.

F. Samples
1. Provide sample of all visible devices such as camera mount, motion detectors, card reader, door contact, etc. for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color selection before purchasing materials.

G. Refer to Division 1 for additional information on shop drawings and submittals.

H. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

I. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

J. Submittals shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. REVIEWED: Contractor does not need to take further submittal action, shall include this submittal in the O&M manual, and verify with Architects and other parties (Owner, etc) reviewing the submittals that no other correction is required before placing orders and starting installations.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted, and verifed with Architects and other parties (Owner, etc) reviewing the submittals that no other correction is required before placing orders and starting installations.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

K. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

L. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

M. Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:
1. Fire Alarm System
2. Access Control System
3. Video Surveillance System
4. Intrusion Detection System

N. Refer to each specification section for additional requirements.

1.15 COORDINATION DRAWINGS

A. Before submit shop drawings, Contractor shall prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of Safety and Security conduits/sleeves, pullboxes, equipment, cabinet and other materials. Include the following:
a. Wall and type locations.
b. Clearances from other building structure and MEP equipment.
c. Clearances for servicing and maintaining equipment and cabling, and space for equipment disassembly required for periodic maintenance.
d. Equipment connections and support details.
e. Exterior wall and foundation penetrations.
f. Fire-rated wall and floor penetrations.
g. Sizes and location of required concrete pads and bases.
h. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: cable routing, equipment location, clearance, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 28, include the following information for equipment items:
      a. Identifying names, name tags designations and locations for all equipment.
      b. Fault Current calculations and Coordination Study.
      c. Reviewed shop drawing submittals with exceptions noted compliance letter.
      d. Fabrication drawings.
      e. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
      f. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
      g. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
      h. Equipment name plate data.
      i. Wiring diagrams.
      j. Exploded parts views and parts lists for all equipment and devices.
      k. Color coding charts for all painted equipment and conduit.
      l. Location and listing of all spare parts and special keys and tools furnished to the Owner.
      m. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

6. The Safety and Security Contractor shall deliver the Installer's Warranty and Manufacturer's signed System Warranty.
    a. Delivery shall be completed within two (2) weeks of the time of final punch list review.
    b. Product Certificates shall be signed by manufacturers certifying that products furnished comply with requirements.
7. Testing Report Requirements
    a. Submit certified test reports of Contractor-performed tests. Contractor shall submit the required Test Reports in the format and media specified, upon completion of testing the installed system.
    b. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
    c. Three (3) sets of electronic and hardcopy versions of test reports shall be submitted together and clearly identified with cable designations.
8. Supply Owner with training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

1.17 RECORD DRAWINGS

A. Maintain a continuous record during the course of construction of all changes and deviations in the work from the contract drawings. Upon completion of the work, purchase a set of "Auto Positive Tracings" on vellum and make corrections as required to reflect the electrical systems as installed. Location and size of all conduit shall be accurately shown to dimension. Submit three prints of the tracings for approval. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. Record drawings shall be furnished in addition to shop drawings. Symbols on the Record drawings shall correspond to the identification symbols on the contract drawings and equipment identification plates and tags.

B. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

C. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

D. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed device and cabling, and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

E. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.

F. When the option described in paragraph E., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:
    CERTIFIED RECORD DRAWINGS
    DATE:

(NAME OF GENERAL CONTRACTOR)
BY:_____
(SIGNATURE)
(NAME OF SUBCONTRACTOR)
BY:_____
(SIGNATURE)

1.18 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 28.

1.19 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 28 Sections for additional Operator Training requirements.

1.20 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.21 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. See requirements in Division 1 Specifications.

C. The Security Integrator shall warrant all completed work, including all materials and labor, to be free from defects in design, workmanship, and/or materials for a period of two (2) years from final acceptance date.
   1. System acceptance is defined as the completion of all functional performance testing and the resolution of all punch list items.

D. Warranty Service
   1. In the event that defects in the materials and/or workmanship are identified during the warranty period, the contractor shall provide all labor and materials to correct the deficiency.
   2. All service work shall be performed by factory certified technicians.
   3. All warranty service shall include the replacement of all parts and or components as required to restore normal system operation.
      a. If parts or components need to be repaired, a loaner will be supplied and installed until the part or component can be repaired and reinstalled.
   4. Immediately following a warranty service request, the Contractor shall provide written documentation to Owner which details the service work completed, cause of trouble, and any outstanding work required to restore a complete and normal system.

E. Warranty service requests shall be responded to within 4 hours of notification with a qualified service technician on site.

F. All repairs shall be completed within 48 hours upon site arrival.
   1. If the failure exceeds 48 hours, the Owner reserves the right to require the contractor provide on-site manufacturer support at no additional cost to Owner.

G. Extended warranties on equipment components offered by the manufacturer shall be passed through to the Owner.
   1. Warranty provisions shall be fully transferable only at the direction of the Owner, in the event that ownership of the installed security systems is transferred.

1.22 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.
   1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
   2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
   3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

1.23 PRE-INSTALLATION MEETINGS

A. Safety and Security Contractor shall attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section. This venue is to ask and clarify questions in writing with consultant and/or project manager/Owner representative.
   1. Agenda
      a. Safety
      b. Work to be performed
      c. Scheduling
      d. Coordination
      e. Other topics as necessary
   2. Attendance
      a. Safety and Security project manager/supervisor shall attend meetings arranged by General Contractor, Owner's representatives, and other parties affected by work of this document.

b. All individuals who will serve in an on-site supervisory capacity, including project managers, site supervisors, and lead installers, shall be required to attend the pre-installation conference.

c. Individuals who do not attend the conference will not be permitted to supervise the installation and testing of Safety and Security cables on the project.

1.24 CONTRACT ADMINISTRATION

A. The Engineer may perform site visits and provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the client.

B. Job Field Report outline:
1. General: The general installation progress in relation to scheduled work made by the Contractor up to that date.
2. Deficiencies and/or Items of Note: Documents observations of the cable installation that may require corrective action by the Contractor.

1.25 POST INSTALLATION MEETINGS

A. At the time of substantial completion the contractor shall call and arrange for a post installation meeting to present and review all submittal documents to include but not be limited to As-Built Drawings, Test reports, Warranty paperwork, etc.

B. Attendees shall include

a. Safety and Security Contractor

b. Project Manager/Owner Representative

c. General Contractor

d. Safety and Security Engineer.

e. Other trades that the GC deems appropriate.

C. At this meeting the Safety and Security Contractor shall present and explain all documentation.

D. Any discrepancies or deviations noted by and agreed to by participants shall be remedied by the Safety and Security Contractor and resubmitted within one (1) week of the meeting.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:
1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 GENERAL REQUIREMENTS

A. All materials and products used on this project shall be listed by Underwriters' Laboratories.

B. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of Safety and Security cabling products and shall be the manufacturer’s latest standard design in satisfactory use for at least one year prior to bid opening.

C. All material and equipment, as provided, should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products.
   1. All shall be typical commercial designs that comply with the requirements specified.
   2. All material and equipment shall be readily available through manufacturers and/or distributors.

D. Installer is to comply in every way with the requirements of local laws, ordinances, and rules, the National Board of Fire Underwriters, and the National Electrical Code.

E. In the event of any conflicts between documents referenced herein and the contents of this specification, the Installer is to notify in writing to the Architect/Engineer of any such occurrences before the purchasing of any equipment, materials and/or installation by the Installer. The Architect/Engineer will notify the Installer of any actions required to resolve these conflicts.

F. No change in the plans or in the specifications is to be made without written instruction to do so from the Owner or Architect/Engineer.

G. Materials are to be installed in accordance with manufacturer’s recommendations and best industry practices.

H. The Installer is to promptly correct all discrepancies and/or defects for which the Installer is responsible.

I. The Installer is to maintain a set of working specifications and drawings on site at all times and to make this set available for inspection during site visits.

J. All materials are to be new and of the highest quality.

K. All products installed in the above ceiling space are to meet or exceed the Underwriters Laboratories (UL) fire rated cable insulation requirements and are to be Plenum rated.

L. The Installer is to seal ALL penetrations, conduits, sleeves, cable trays, etc., where cabling has been installed through rated walls/floors with Wiremold Flamestopper intumescent fire- stop system (or approved equivalent) where they pass through rated walls. The Installer is responsible for returning any and all penetrations through rated walls or floors made for Safety and Security cable to their pre-penetration rating.
   1. All material used to dress cable bundles shall be applied loosely to allow the dressing material to slide around the bundle. Tension of dressing materials shall not deform the cable sheath. Dressing materials should be limited to the Safety and Security rooms only. Cabling shall be placed unbundled in cable tray and/or j hooks in the above ceiling spaces. No bundling materials are to be used above ceiling. All j hooks installed shall include the corresponding clip provided by the hook manufacturer. Plastic cable ties will not be permitted.

M. Any discrepancy in the contract documents is to be remedied by the Installer providing and installing the newer, greater quality or quantity of the item or items in question.

N. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

O. Provide nylon bushings for all conduit openings.

P. All horizontal cables not in a cable tray or conduit shall be supported at a maximum of 48 to 60 inch intervals. Cable support system is to be independent of supports for other trades. At no point shall cable(s) make contact with acoustic ceiling supports, grids, panels, electrical conduits, water pipes or HVAC ductwork or supports.

Q. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the installer prior to final acceptance at no cost to the Owner.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.4 FIRE STOPPING

A. Contractor shall restore the fire rating of penetrations to rated walls, ceiling, flooring after cable pulling. Fire stopping products shall be as follows:
   1. Hilti
   2. SpecSeal
   3. 3M
   4. Owner approved alternate

2.5 IDENTIFICATION (LABELING) SYSTEM

A. Contractor shall label al communications system components installed. Labeling products shall be as follows:
   1. Brady (LAT-19-361-4)
   2. Dymo
   3. Hellerman-Tyton
   4. Owner approved alternate

2.6 ESCUTCHEONS

A. Provide heavy chrome or nickel-plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.7 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.8 PAINTING

A. All factory assembled equipment shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements
   1. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

B. Established Dimensions
   1. Where field measurements cannot be made without delaying the work, coordinate with the General Contractor to establish dimensions.
   2. When approved in writing, proceed with fabricating units without field measurements.
   3. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

C. Pre-installation inspection
   1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
   2. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

3.2 DEMOLITION AND REMODELING

A. Where only portions of the existing Safety and Security system are to be modified as part of the renovation and addition project, devices related to or part of this system outside of the renovation area shall be kept in operations.

B. The Drawings do not show all demolition work required. The Contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C. Utility service outages required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two (2) weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

D. The contractor shall perform a preconstruction walk thru of the site to observe and test the existing systems for operation. The owner assumes that the system is 100% operational and functioning prior to the commencement of construction. If any portion of the system observed or tested to be non-functional or inoperable at the commencement of the project will be noted by the contractor. A written report will be generated by the contractor noting their findings and submitted to the project team for review and handling. The owner will determine if the items found to be non-functional are to be repaired by contractor or repaired by the owner. If this repair of the equipment found to be non-functional is to be added to the contractor's scope of work the contract amount for the Work shall be adjusted accordingly.

E. Work Sequence and Timing. The Owner will cooperate with the Contractor; however, the following provisions must be observed:
   1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, Safety and Security, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
   2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and Sub-subcontractors, and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

F. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing safety and security devices and headend equipment. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

G. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

H. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

I. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

J. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

K. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

L. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

M. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

N. When applicable, Include in the contract price all rerouting of existing backbone cabling, , etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing Safety and Security rooms in areas scheduled to remain operational with a minimum of interruption.

O. All existing cabling, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

P. Cabling and equipment serving Safety and Security system which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

Q. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

R. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

S. Field verify measurements, and cabling arrangements are as shown on Drawings.

T. Verify that scheduled cabling and equipment serving only those abandoned devices to be demolished and removed in its entirety.

U. Demolition Drawings are based on casual field observation and existing Record Documents. Report discrepancies to Architect and Engineer before disturbing existing installation.

V. Beginning of demolition means that the contractor accepts existing conditions.

W. Demolish and extend existing Safety and Security work under provisions of Division 02 and this Section.

X. Remove, relocate, and extend existing systems to accommodate new construction.

Y. Remove abandoned cabling to source of origination point. Remove racks and other equipment as scheduled on the drawings.

Z. Remove exposed / abandoned cabling systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

AA. Repair adjacent construction and finishes damaged during demolition and extension work.

BB. Maintain access to existing systems which remain active. Modify installation or provide access doors as appropriate.

CC. Extend existing systems using materials and methods compatible with existing systems, or as specified.

DD. Clean and repair existing materials and equipment which remain or are to be reused. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operating condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

EE. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

FF. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

GG. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

HH. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

II. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

JJ. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

3.3 INSTALLATION

A. General
   1. Contractor shall install work in accordance with specifications, drawings, manufacturer’s instructions and approved submittal data.

B. Allowable cable bend radius and pull tension:
   1. Refer to cable manufacturer's bend radius recommendations for the maximum allowable limits.

2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.

C. Pull Strings
1. Provide pull strings in all new conduits, including all conduits with cable installed (trailer strings) as part of this contract.
2. Data and video cables can be pulled in tandem with pull strings.
3. The pull strings must move freely to prevent cable jacket/cable damage during pulls.

3.4 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3” of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.5 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of Electronic Safety and Security work shall be concealed in walls, chases, under floors and above ceilings except:
1. Where shown to be exposed.
2. Where exposure is necessary to the proper function.

3.6 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C. All un-used sleeves shall be sealed with 2-hour UL approved fire sealant manufactured by “3M” or approved equal.

3.7 LABELING

A. Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

B. Flat-surface labels: Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.

C. Provide transparent plastic label holders, and 4-pair marked colored labels.

D. In accordance with ANSI/TIA-606-B "Administration Standard for Commercial Telecommunications Infrastructure":
1. Install colored labels according to the type of field as per color code designations.

2. Use “designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields”.

E. Pathway Labels and Labeling System
1. Labeling system shall consist of a hand-held portable printer
2. Conduits: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive. Label size shall be appropriate for the conduit size. Font size shall be legible from the finished floor.
3. Inner duct: Polyethylene general-purpose tagging material attached using tie wraps.
4. Junction boxes: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name. Font size shall be easily visible from the finished floor.
5. All labels shall be permanent, i.e. will not fade, peel, or deteriorate due to environment or time.
6. Identification
    a. All conduits, junction boxes, gutters, and pull boxes shall have machine-generated labels easily visible from the finished floor.
    b. Conduits shall be labeled with the word “Security” and the conduit’s origination room number and destination room number.
    c. The Contractor shall label conduit at each wall and floor penetration and at each conduit termination, such as outlet boxes, pull boxes, and junction boxes, or as otherwise specified in other sections.
    d. Junction boxes, gutters and pull boxes shall be labeled with identification name or number as determined by contractor and submitted for approval.
    e. The Contractor shall label conduit sleeves at each wall and floor penetration.

3.8 FIRESTOPPING

A. Provide approved fire-resistant materials to restore originally-designed fire-ratings to all wall, floor, and ceiling penetrations used in the distribution and installation for Safety and Security cabling system.

B. Install and seal penetrations (conduit, sleeves, slots, chases) in fire-rated barriers created for Safety and Security infrastructure to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.

C. The firestopping material shall maintain/establish the fire-rated integrity of the wall/barrier that has been penetrated.

D. All through penetrations in a fire rated surface require a sleeve, regardless of penetration diameter or penetrating cable count.

E. Using a “ring and string” method of installing cabling for membrane penetrations in a wall cavity is acceptable, provided the solution was accepted by the Owner in writing. Code-compliant firestopping rules still apply.

F. Coordinate firestopping procedures and materials with General Contractor.

G. Sharing the pathway of other trades/utilities through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant firestopping.

H. Provide and install removable, intumescent mechanical systems in floor chases for all openings greater than 0’-4”.

I. Provide and install removable, intumescent, firestop bricks for all openings greater than 0’-4” where there are penetrations through walls.

J. Bricks shall be listed for insertion in fire-rated openings and require restraining materials or apparatus as needed per manufacturers' specifications.

K. Provide manufacturer recommended material for rated protection for any given barrier.

L. Laminate and permanently affix adjacent to chases the following information:
   1. Manufacturer of firestop system.
   2. Date of installation/repair.
   3. Part and model numbers of system and all components.
   4. Name and phone numbers of local distributor and manufacturer's corporate headquarters.

M. Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.

N. Materials shall be installed per manufacturer instructions, be UL-listed for intended use, and meet NEC and locals codes for fire stopping measures.

O. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

P. Develop training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

Q. Within the normal environment, the installed systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.

R. Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in cables, positions in patch panels, cross connects, and terminal strips, and space in cable pathways and backboard layouts to accommodate 20% future increase in structure cable system capacity.

S. In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to make the cabling system work and comply with the applicable manufacturer written technical recommendations and standards.

3.9 WALL MOUNTED EQUIPMENT

A. Install all wall mounted equipment in accordance with the National Electrical Code, industry standards and as shown on the drawings.

B. Unless noted otherwise, all wall mounted equipment that need to be accessed for operation or maintenance shall be mounted at a working height not requiring a ladder when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices(note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.10 CLEANING

A. The Contractor will clean all surfaces of equipment and devices prior to final acceptance by Owner.

3.11 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.12 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:
   1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
   2. All devices, equipment, and equipment cabinets/enclosure shall be cleaned and in operating condition.
   3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
   4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
   5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

3.13 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted, and Owner is satisfied that all work is in accordance with contract documents, the Owner shall notify Contractor in writing of formal acceptance of the system.

B. Contractor must warrant in writing that 100% of the installation meets the requirements specified herein (Standards Compliance & Test Requirements).

C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation soft and hard copies as described herein.

END OF SECTION

SECTION 2 13 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section identifies the requirements, technical design, and specifications for the access control system at the Fort Bend ISD George Bush High School Renovations And Additions located in Richmond, Texas (“Owner”). The access control system as specified is an Industry-Standard access control system that shall be an extension of the District’s existing system and includes (existing) access control server, (existing) access control software, control panels, card readers, credentials, cabling, power supplies, and any associated software, hardware, or licensing as specified.

B. It is the Contractor’s responsibility to review this specification and associated project specifications and drawings in their entirety, prior to bidding on the project. By bidding on this project, the contractor acknowledges that they have read and fully understand these specifications, with no exceptions. Contractor shall review the drawings, specifications, and existing conditions prior to bidding on the project. Any discrepancies shall be brought to the attention of the Architect / Design Consultant via request for information (RFI) in writing for evaluation and or clarification. If these items are not brought to the attention of the Architect / Design Consultant the more costly or difficult manner, and the better quality or greater quantity of work shall be provided by the contractor in accordance with the Architect's / Design Consultant’s interpretation at no additional cost to the owner.

C. Contractor shall furnish and install all materials, equipment, and labor necessary to provide a complete and functional turn-key access control system regardless of any items not listed or described in this specification or associated drawings.

D. Requirement Sections Table of Contents

1.3 Contractor Experience Requirements

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3.3 Coordination Requirements

3.4 System Requirements

3.5 Testing Requirements

3.6 Training Requirements

3.8 Substantial Completion

3.9 Project Closeout Documentation

1.2 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 28 and shall be complied with in every respect. The Contractor shall examine all the items which make up the Contract Documents and shall coordinate them with the work on the project.

1.3 CONTRACTOR EXPERIENCE REQUIREMENTS

A. The Contractor shall be a certified DSX Access Control System Partner prior to submitting a bid for the work.

B. The Contractor shall possess all relevant DSX Manufacturer Certifications (i.e., access control systems, hardware installation, software installation and programming) for both the company and individual technicians prior to submitting a bid for the work.

C. The Contractor shall have a DSX manufacturer certified technician onsite throughout the duration of the installation phase of the project.

D. The Contractor's Project Manager shall be dedicated to this project for the duration of the project and shall be available for all onsite coordination meetings.

E. The Contractor shall have been in business for a minimum of five (5) years.

F. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

G. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

H. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.4 SUBMITTAL REQUIREMENTS

A. Bid / Proposal Submittal

1. Contractor shall provide as part of their bid/proposal:

a. Breakdown of proposed parts and labor required for the completion of the project. Include documentation showing annual licensing cost of ownership.

b. Proposed construction schedule in a Gant chart format

c. Contractor Safety Plan detailing safety practices around the jobsite.

d. Contractor QA / QC process detailing processes and procedures to ensure quality workmanship during installation and troubleshooting.

e. A detailed description of the installation team(s) that would perform the work.

f. A resume for each of the key project personal.

g. Licensed in the State of Texas.

h. Contractor is responsible for procuring all applicable access control permits required for this project with Fort Bend County / Fire Marshall.

i. Submitting Contractor must be certified to install products and services for systems they are proposing. No subcontract of services will be allowed for any security scope of work. Contractor must submit to the Owner prior to starting any work the factory training certifications for all personnel that will be working on the system.

B. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect / Design Consultant.

2. The Contractor is responsible for notifying and obtaining written approval via RFI from the Architect / Design Consultant / Owner of any proprietary devices, software, and/or installation processes.

3. Contractor is responsible for obtaining permitting as required in accordance with the authority having jurisdiction (AHJ), local, city, state, federal, and/or applicable law requirements.

4. Contractor shall ensure submittals are submitted in 15 business days of award to ensure all products can be ordered and received on site in order to not cause any delays. Any products having long lead times (more than 60 days) that may negatively impact the schedule shall be clearly identified in writing so the review and approval can be expedited.

5. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e., product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

6. Contractor shall provide the following as part of their submittal:

a. Manufacturer product data sheets for each proposed system component.

1) For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being

submitted. Product data sheets without the part number clearly identified will not be approved.

2) Contractor shall identify any products that are discontinued, end of life, or near end of life, and shall propose equal alternate to the discontinued product in writing.

b. Manufacturer Product Certifications for Company.

c. Manufacturer Product Certifications for Installers.

d. Manufacturer Warranty letters.

e. Documentation indicating that Contractor has been in business for (5) years.

f. Address of Contractor's local office within a 75-mile radius of the project site.

g. Quantity of full-time, local technicians within a 75-mile radius of the project site.

h. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

i. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

j. List of subcontractors performing any work on the project. List shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

k. Manufacturer's certification letter confirming that the proposed access control system components do not have any known cybersecurity notices, bulletins, or alerts. If a vulnerability is discovered, the contractor shall notify the Architect / Design Consultant within 24 business hours. Provide the make and model of the associated equipment and the vulnerability.

l. Manufacturer cybersecurity hardening guide. If one is not available, provide documentation from the manufacturer stating such.

m. A complete set of shop drawings to include at minimum but are not limited to:

1) Proposed and/or samples of original contractor security schedules. Schedules are not to be copy/paste of schedules provided within the contract documents. Schedules proposed shall be utilized as part of As-Built drawings with coordination with Div. 27 for additional information as required for network components.

a) Device and equipment schedules shall include at a minimum but are not limited to:

(1) Device Label

(2) Device Type

(3) Device Power Requirements

(4) Terminating MDF / IDF / Panel Location

b) Additional networking information as required to include:

(1) Rack

(2) Network switch

(3) IP addresses

(4) Patch panel

(5) Surge/lighting protection

(6) Power source

2) Elevation and Topography Drawings to illustrate the associated devices and equipment and the heights at which they will be installed.

3) Signal Flow Diagram including full security topology.

n. Supplemental documents to include at a minimum but are not limited to:

1) Contractor Safety Plan detailing steps Contractor will take to ensure a safe work environment.

2) Contractor QA/QC Document to include bench testing / initial configuration of all critical system components including but not limited to:

a) System Server(s)

b) Cameras

c) Contractor Furnished Workstations (if applicable)

3) Construction Schedule in a Gant chart format

4) Contractor Cybersecurity Hardening Guide detailing Contractor's internal policies for preventing the introduction of cyberthreats to the Owner's technology / security infrastructure.

a) Contractor Certification Letter utilizing company letterhead detailing the company policies and procedures.

b) Contractor shall provide a cybersecurity plan detailing their internal policy for preventing the introduction of cyberthreats to the Owner's technology / security infrastructure.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. All software, hardware, and equipment (from the date of RFP) shall be tested, currently available and commercially off the shelf product. (COTS).

C. All wiring, equipment, and installation materials shall be Commercial Grade, new, and of the highest quality to meet or exceed the performance and features of the equipment and devices specified herein.

D. Written approval must be obtained from the Architect / Design Consultant / Owner for any proprietary or custom software and/or equipment prior to the beginning of the project.

E. All devices shall be installed with the manufacturer recommended mounts and accessories as necessary for the installation locations type as scheduled.

F. Unless otherwise stated, all software and licensing shall be for the most current, up to date version of the system provided. For existing systems, Contractor shall obtain written verification of the Owner's most current software version and notify via RFI the Architect / Design Consultant / Owner if implementation of the most current software / license version will require an upgrade to the Owner's existing system.

G. Architect / Design Consultant / Owner will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

H. Proposed equivalent items must be approved in writing by the Architect / Design Consultant / Owner prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

I. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall submit a formal RFI for an appropriate substitute.

J. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished at no additional cost to the owner.

K. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

L. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

M. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect / Design Consultant / Owner. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the job as per the project schedule.

N. Any quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a fully functional turkey system. Where quantities are not noted, Contractor shall refer to drawings and schedules to determine exact quantities.

2.2 ACCEPTABLE MANUFACTURERS

A. Access Control System Manufacturers

1. **DSX**

B. ACS Server

1. WinDSX Access (Existing, Owner provided.)

C. Access Control Software

1. WinDSX Access (Existing, Owner provided.)

D. ACS License

1. Contractor to provide licensing as required.

E. Client Workstation

1. Owner Furnished, Owner Installed

F. Badging Workstation

1. Owner Furnished, Owner Installed

G. Badging Printer

1. Owner Furnished, Owner Installed

H. Intelligent Controllers

1. DSX-1042PKGNV (Master)
2. DSX-1048PKG
3. DSX-1042PKG

I. Door Controllers

1. DSX-1042

J. Input Controller

1. DSX-1044

K. Output Controller

1. DSX-1043

L. Communication Module

1. DSX-IP-HUB (Master)
2. DSX-LAN (Master Sub Panel)

M. ACS Panel Power and Lock Supply

1. DSX-1040PDP Power Distribution Panel with DSX-SP320-27

N. ACS Power Supply Battery
   1. 12V 7AH Battery (2) per Power Supply
      a. Yuasa
      b. Or approved equal

O. Card Reader
   1. Wall Mount
      a. HID Proximity ThinLine II 5395 (Black)
   2. Mullion Mount
      a. HID ProxPoint Plus 6005 (Black)

P. Door Contact
   1. Recessed SPST
      a. GRI 180-12
      b. GRI 195-12 (DPDT)
      c.Or approved equal
   2. Surface Mount with armored cable
      a. GRI- 4402-A
      b. GRI 4405-A (DPDT)
      c.Or approved equal

Q. Request to Exit
   1. Unless otherwise noted, the request to exit shall be integral with the electrified door hardware. Reference Section 08710 - Finish Hardware.
      a. Request to Exit – PIR Motion Sensor (used on Electric Strike access controlled doors)
         1) Bosch DS160
         2) Or approved equal

R. Access Cards
   1. Contractor shall provide (100) access control cards. Coordination with Fort Bend ISD Design Manager is required for the exact type.

S. Door Release, Duress, Panic and Lockdown Button
   1. Latching Hold-up Switch
      a. HUSK20
   2. Door Release Button Momentary
      a. HUB-2SA
   3. Lockdown Blue Mushroom Button - Wall Mount with Cover
      a. STI SS2421LD-EN
      b. Or approved equal

T. Access Control System Cabling
   1. Lake Cable (Color Orange, Plenum Rated, Cable shall be sized based on length).
      a. Card Reader – 22 AWG / 6-Conductor (Shielded)
      b. Lock Power – 18 AWG / 4-Conductor
      c. Request to Exit – 18 AWG / 4-Conductor
      d. Door Contact – 22 AWG / 4-Conductor

e. Door Release Button - 18 AWG / 4-Conductor
f. Lock Down Button - 18 AWG / 4-Conductor.
g. Video Intercom Input / Output - 18 AWG / 4-Conductor.
h. RS-485 (Twisted, Shielded)
i. RS-232 (Twisted, Shielded)
j. Or approved equal

2. Outside Plant Cables (Cable shall be sized based on length).
a. Card Reader – 18 AWG / 6-Conductor (Shielded)
b. Gate Controller - 18 AWG / 4-Conductor
c. Lock Power – 16 AWG / 2-Conductor (Minimum) Contractor shall size cable gauge per manufacturer's distance parameters.
d. Or approved equal

U. Video Intercom
1. AiPhone – IX Series 2
a. Master Station (PoE)
1) IX-MV
b. Video Door Station (PoE)
1) Mullion Mount
a) IX-DVM
c. Input/Output Network Adaptor (PoE)
1) IXW-MA
2. AiPhone Intercom System Cabling
a. By Division 27 10 00 Structured Cabling System
b. IP Intercoms – Category 6 Plenum rated - White Cable Jacket (By Others).

V. Pathway Cable Support
1. Panduit J-Mod Cable Support System
2. Erico – CADDY CAT LINKS J-Hook Series
3. Panduit Plenum Rated Hook Loop (Black)

W. Labeling
1. Permanent Labels for Copper Cables
a. Panduit Self-Laminating Labels
b. Or approved equal.

X. Fire Stop
1. STI Spec Seal
2. 3M Products
3. Or approved equal.

PART 3 - EXECUTION

3.1 CODES, STANDARDS, REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)
1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire

2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition
2. Outside Plant Design Reference Manual 5th Edition
3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling
5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998
2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
3. FCC Part 76, Cable Television Service, revised 1998

F. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive
3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code
5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

I. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
3. ISO/IEC 14443-3:2011 – Identification Cards
4. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

J. National Cable Television Association (NCTA)

K. National Electrical Contractors Association (NECA)

1. NECA 1-2015 Good Workmanship in Electrical Construction

L. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)
   1. NFPA-70, National Electrical Code
   2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
   3. NFPA-101, Life Safety Code
   4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
   5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)

O. Occupational Safety and Health Administration (OSHA)

P. Security Industry Association (SIA)

Q. Telecommunications Industry Association (TIA)
   1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.
   2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.
   3. ANSI/TIA -568.0-D.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
   4. ANSI/TIA-568.3-D-1, Optical Fiber Cabling Components Standard.
   5. ANSI/TIA–569-E Commercial Building Standard for Telecommunications Pathways and Spaces.
   6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure.
   7. ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
   8. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

R. U.S. Department of Agriculture (USDA)
   1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
   2. RUS Bull 1751F-643 (2002) Underground Plant Design
   3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
   4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
   5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)
   6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)
   7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)
   8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

S. Underwriters Laboratories, Inc. (UL)
   1. UL 294 Standard for Access Control System Units
   2. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Access Control Systems and Equipment
   3. UL 109 Standard Method for Flame Tests of Flame-Resistant Fabrics and Films
   4. UL 1076 Standard for Proprietary Burglar Alarm Units and Systems

3.2 EXECUTION - GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect / Design Consultant for direction before proceeding with that part of the work.

B. Contractor shall meet the specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines. Equipment and materials installed by the Contractor shall be free of defects and damage.

D. No deviations from the plans, details or specifications shall be made without full consent in writing of the Architect / Design Consultant. The Contractor shall have written approval from the Architect / Design Consultant for any additional work beyond the Contract Documents prior to beginning such work.

E. Prior to execution, Contractor shall verify no changes in software, licensing or hardware versions have occurred since the bidding of the project. In the event of any changes, Contractor shall verify system compatibilities with their proposed design, and notify via RFI the Architect / Design Consultant / Owner if the newest version(s) will require any upgrades / additional costs to the existing system(s).

F. In the event site conditions do not allow the contractor to follow the execution requirements specified herein or in the provided details, the Contractor shall submit via RFI an alternative means and methods that is approved in writing by the Architect / Design Consultant.

G. The Contractor shall obtain written permission from the Architect / Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to: girders, beams, floors, walls, roofs, and/or ceilings.

H. If the Contractor does not obtain written approval from the Architect / Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

I. Contractor shall notify the Architect / Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect / Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

J. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

K. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

L. Contractor shall test all cables prior to and post installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

M. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect / Design Consultant.

N. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

O. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

P. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect / Design Consultant.

Q. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

R. All devices shall be installed flush, plumb, and (where required) centered on the wall, ceiling tile or structure for which it is being installed, unless otherwise noted.

S. Devices installed in public spaces shall be mounted and secured using tamper-proof security fasteners unless otherwise noted.

T. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

U. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

V. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

W. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

X. The manufacturer and contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owners technology infrastructure. These measures shall include but are not limited to:

1. The contractor shall scan contractor owned equipment for cyber threats such as viruses, malware, ransomware, etc., prior to connecting the contractor owned devices to the Owners network.

2. Ensure all technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics, i.e., servers, and other associated equipment.

3. All project documents shall be properly securely stored behind encryption and password protection to avoid unauthorized distribution of documents.

Y. Labeled Doors and Frames

1. In no instance shall any UL labeled door or frame be drilled, cut, penetrated, or modified in any way.

2. The Contractor shall be responsible for replacing any labeled door or frame that is modified without written approval from the Architect.

3.3 COORDINATION REQUIREMENTS

A. The Contractor is responsible for the coordination of the following items and their respective disciplines included but not limited to.

B. Coordinate with the Architect to ensure that:

1. Adequate conduit is provided and that equipment backboxes are adequate for system installation.

2. Adequate power has been provided and properly located for the security system equipment.

3. Doors and door frames are properly prepared for electric locking hardware and door position switches.

4. Access hatch locations (when required) shall be submitted in writing via RFI and coordinated with the Architect.

5. Finishes and colors of all equipment visibly installed in public areas. Submit all finish and graphics for all equipment to the Architect for approval prior to installation.

C. Coordinate with the Division 8 contractor for the following:

1. Door hardware manufacturer installation and power requirements.

2. Installation, power, and requirements for integral request to exit switches.

D. Contractor is responsible for coordinating with gate controller installers for controller locations and interfacing terminations.

E. Coordinate with the Division 26 contractor for the following:

1. Power requirements, conduit sizes/pathways, sleeves, back boxes, grounding, and bonding requirements of security devices in the following locations:

a. Interior of the building

b. Exterior of the building

c. Pole, pedestals, canopies, awnings, building architectural surface, etc.

d. Special conditions (clean room, hazardous areas, roof top mounted devices, etc).

2. Coordinate location and termination of earth ground for all device specified herein as required per manufacturer installation requirements.

F. Coordinate with the Division 27 contractor for the following:

1. Installation and power requirements of network infrastructure associated to the specified system

2. Associated patch cable lengths and quantities required for the specified system.

3. Location, power, and backup requirements for rack mount equipment.

G. Coordinate with the Division 28 (Fire) contractor for the following:

1. Door hardware manufacturer installation and power requirements associated with fire alarm system(s).

2. Door hardware manufacturer installation and power requirements for all ACS electric locking mechanisms with time-delay (“delayed egress”) functions as defined by NFPA 101.

H. The Contractor is responsible for coordinating ACS locations and mounting preferences of all specified security devices with the Architect / Design Consultant prior to installation.

I. The Contractor is responsible for coordinating all ACS programming requirements with the Owner / Architect / Design Consultant.

J. The Contractor shall coordinate with the Owner for the following:

1. Network IP addressing for networked system equipment, controllers, and devices

2. Device labeling scheme

3. Firmware/software updates

4. Client workstations requirements and locations

5. Location of rack mount equipment.

6. Locations, type, programming, configuration, and Owner’s final expectations for any Contractor Furnished Contractor Installed (CFCI) equipment and devices.

7. Uninterruptible Power Supply (UPS) requirements.

8. Painting of exposed, publicly visible conduit pathways

9. Credential reader card formats, LED, buzzer and associated visual/audio functionalities.

10. When required, credential card ordering, formats, facility codes, barcode and template requirements or standards prior to install. Coordinate timelines for delivery and distribution of the credentials to the Owner prior to procurement.

3.4 SYSTEM REQUIREMENTS

A. General

1. The Access Control System (ACS) shall consist of server(s), software, licensing, workstations, doors controllers, access control cabling, credentials and all other peripheral components as indicated on the drawing and specified herein.

2. Any devices associated with the installation shall have the latest firmware updates downloads via owner approved secure link from the system software and/or remotely from the manufacturer.

3. All Access Control software, equipment and system requirements shall be installed per their respective Manufacturer Installation Guidelines.

4. Programming and data entry to be provided by the Contractor. Contractor shall program the Access Control System to provide the following basic functions included but not limited to:

a. Database Importing (Active Directory, CSV file, etc.)

b. Graphics Maps

c. Time zones

d. System Reports

e. Threat / Emergency Management Protocols (Lockdown, Severe Weather, etc.)

f. Role Based User System Access (Admin, User Privileges, etc.)

g. Access levels (Areas, Floor Groups, User Groups, etc.)

h. Schedules (Lock/Unlock, Auto Arm/Disarm, etc.)

i. Auxiliary I/O Devices (Sirens, Strobes, Buzzers etc.)

j. Door Configuration Settings to include but not limited to:

1) Anti-Pass Back

2) Door Release via Push Button Input

3) Door Release via Request to Exit (Maglock ONLY)

4) Door Forced / Door Held Alarms Conditions

5) ADA Door Settings

k. Special Conditions (Fire Alarm Relays, Hold Opens, Elevators, Gate / Door Operators, etc.)

5. When programming and data entry for the system is to be completed by Owner, Contractor is responsible for initial programming to ensure the installed field devices, media converters, etc., are communicating to the head-end equipment, so that the Owner can complete the necessary programming and shall assist in troubleshooting in the event they do not.

B. Access Control System (ACS) Software

1. Application / Client Workstation Software

a. The ACS software shall be installed as the most current version; contractor shall coordinate with owner prior to the upgrade/install to identify and evaluate any software conflicts. Conflicts shall be brought to the attention of the design team prior to bidding via Request for Information (RFI). Contractor shall coordinate the install and configure software on workstation(s) as required to provide a full turnkey ACS system.

C. Access Control System Licensing

1. Contractor shall be responsible for providing and applying all necessary licensing key(s) for the specified system(s) as required by the manufacturer(s) for a fully functioning access control system.

2. Contractor shall maintain a secured document with all license key(s) information applicable to this project. All license key(s) are property of the owner and shall be kept secured at all times and then surrendered to the Owner at the end of the project.

D. Access Control System Hardware

1. ACS Server

a. Existing

2. Communications

a. Communication between servers, and workstations, networked based controllers/sub-controllers will communicate using the Owner provided data network unless otherwise noted. Coordinate with owner for network configuration requirements.

b. The ACS shall also support end to end 128-bit encryption unless otherwise noted.

c. Alternative communications means and methods shall be provided by Division 28 where applicable.

E. Access Control Workstations

1. Operator/Client Workstation

a. OFOI

2. ID Badge Printing Workstation

a. OFOI

3. Access Control System Controller(s)

a. Install Controller(s) in designated MDF / IDF / Mechanical room(s) as indicated on drawings

1) The Controller(s) shall be wall mounted in the ACS manufacturer's UL listed enclosure, unless a separate manufacturer enclosed power supply solution is specified that is specifically designed for the controller board(s) specified herein. The enclosure shall consist of the following

a) Single cover, hinged, with identical key cylinder lock(s) for all enclosure(s). Hinged double doors will not be accepted.

b) Contractor shall furnish, install, and connect tamper switch for all enclosure(s) to the controller(s) as specified. One alarm input is needed per MDF/IDF/Mechanical to alarm via the ACS system when the enclosure is opened.

c) Contractor shall furnish, install, and connect Battery Fail/Power Loss alarm inputs to the controller(s) as specified. One alarm input is needed per MDF/IDF/Mechanical to alarm via the ACS system in the event of low battery/power loss conditions.

d) Enclosure(s) shall be mounted flush, plumb, and properly secured on fire-rated plywood using appropriate mounting hardware. Pathways to or from the enclosure(s) shall mechanically protected in a conduit or gutter system. Exposed cabling is not permitted.

b. Device power shall be provided from a UL listed power supply or PoE powered network switch where required in accordance with the manufacturer's requirements.

c. Controller(s) shall be installed per the construction documents.

d. Controller(s) shall be installed and configured in accordance with the most current manufacturer installation instructions.

e. The installation shall be performed or directly supervised by a manufacturer-certified technician.

1) The term "supervised" means the certified technician shall be on-site and supervising the installation.

2) The certified (on-site) technician shall have a copy of the manufacturer certification on-site readily available for review.

3) The manufacturer certification shall be current and valid.

F. Access Control System Card Readers

1. Provide card reader(s) as indicated on the drawings.

2. Readers shall be securely mounted flush and plumb on the wall/mullion per the manufacturer installation guidelines.

3. Exterior card readers shall be installed with a weather-proof gasket as recommended by the manufacturer.

4. Exterior card readers mounted on gates or vehicle pedestals shall be securely mounted in a NEMA rated weather-proof enclosure.

5. Where a weather-proof gasket is not sufficient for weather-proof protection, a polyurethane sealant for exterior use shall be applied.

6. Readers shall be installed with the manufacturer provided tamper-proof security fasteners, unless otherwise approved in writing by Architect / Design Consultant. If tamper-proof security fasteners are not provided, the contractor is responsible for procuring the requested hardware at no cost to the owner.

G. Access Control System Credentials (Cards, Vehicle Tags, PIN, Biometric)

1. All credential cards shall be surrendered to the owner in their original packaging after procurement.
2. Template / Card Format / PIN numbers
    a. Security Contractor shall coordinate PIN number assignment with the Owner prior to any programming.
    b. Security Contractor shall maintain a digital record of all Template / Card Format / PIN numbers to be secured at all times, and then provide to Owner at Project Close-Out.
3. Unless otherwise directed, the contractor is responsible for the mounting of vehicle tags. Contractor shall confirm with the Owner the placement of interior / exterior vehicle tags in writing.

H. Door Position Sensors (Door Contacts, Tamper Switches)

1. Provide magnetic concealed door position switches, surface mount door position switches and overhead door position switches to monitor the open/closed status of doors as specified herein and as indicated on the drawings.
2. The contractor shall ensure the circuit of the door position sensor shall match the physical status of the door opening i.e., Normally Closed when the door is closed.
3. Exterior mounted door position sensors shall terminate using the appropriate outdoor-rated weatherproof connections and fasteners based on site conditions.
4. Provide flexible metallic conduit (as required) from the sensor location to the associated junction box as indicated on the drawings. Conduit shall be securely fastened to the structure using proper fasteners based on site conditions.
5. Contractor must ensure adequate spacing between contact and magnets to avoid abrasion / damage to the device.
6. Install end of line resistors for line supervision. Refer to manufacturer for recommended resistance values
7. Tamper shall be mounted inside the enclosure on key switch side.

I. Request-to-Exit

1. For doors equipped with electric locking mechanical that are free exiting at all times (i.e., mortise electric locks, electric strikes, etc.), the REX motion sensor shall only shunt the door position sensor from the Access Control System unless otherwise noted.
    a. Integrated in Electrified Door Hardware
        1) Security Contractor shall route cable from door controller to access controlled door as indicated on the drawings and terminate the specified cable to the top of the Division 8 installed Electrified Power Transfer Hinge.
            a) At the time of installation of the door hardware, The Security Contractor shall provide and install all end of line resistors required by the PACS System Manufacturer.
            b) Security Contractor shall not remove Division 8 Installed Door Hardware unless otherwise approved in writing by the Architect / Design Consultant.
    b. Request-to-Exit Motion Sensor
        1) Motion sensor shall be mounted flush, plumb, and properly secured on a single gang box or mechanical brace using appropriate mounting hardware and trim plate.
        2) Motion sensors shall be positioned close to the door opening and angled to prevent tampering from forced entry. Contractor shall ensure devices mounted in the ceiling space are not obstructed or impacted when servicing in relation to other ceiling mounted devices (Exit signs, smoke detectors, lighting fixtures, etc.)

J. Door Release / Lockdown

1. Security device cabling installed in the knee space shall be mechanically protected with an armored flex from the rough-in back box to the edge device as scheduled. No exposed cabling is permitted.
    a. Door Release / Lockdown shall be wired to the Access Control System input boards as scheduled.
        1) The Door Release / Lockdown button shall be mounted flush, plumb, and properly secured as scheduled.
            a) The Door Release button shall be configured as momentary.
    b. Duress buttons shall be installed under desk at the reception area and the Principal's desk.
        1) Duress button shall alert Fort Bend ISD Police Department.
        2) Provide desk-mounted or wall mounted personnel duress alarms with normally closed alarm output contacts as indicated on the drawings.
    c. Lock down button shall be located by the fire alarm panel inside the Administration area.
        1) Lockdown shall be wired to the Access Control System input boards as scheduled.
        2) Duress / Lockdown button shall be mounted flush, plumb, and properly secured as scheduled.
        3) The Lockdown button shall be configured as latching.
            a) Security Contractor shall configure lockdown button when pressed to close and lock Classroom pod/wing in order to secure each pod/wing independently in the case of a lockdown.
            b) will be the responsibility of the Security Contractor to coordinate with the Fire Alarm Contractor to configure/program all the doors at Classroom pod/wing with magnetic hold open configuration should allow for the ability to secure each pod/wing independently in the case of a lockdown. This can be accomplished with doors that separate these areas and that are tied to the lockdown system.

K. Access Control Intercom Systems
    1. Unless otherwise stated, all intercom configurations shall be Contractor Programmed.
    2. Intercom shall be configured to dial to the associated handset unless otherwise stated.
    3. Door Release via the PACS shall be initiated through programming and relay cabling from the intercom / intercom master station to the associated door relay board.
    4. Coordinate audio recording requirements from intercom systems

L. Electrified Door Hardware Mechanical Connections (Division 8)
    1. Contractor shall conceal security cabling in door frame, door channels, walls wherever possible. Submit RFI if site conditions do not allow and propose alternative methods of terminations.
    2. The Division 28 Contractor shall not make any modifications to fire rated doors without obtaining written permission from the Architect.
    3. The Division 28 Contractor is responsible for providing the following:
        a. Provide relay signal cabling only from the ACS to the Division 8 power supply or relay board(s) located either at the door or centralized location
        b. Termination of Lock Relay Power for PoE based networked door controllers up to the electrified door hardware
        c. Device power provided by Owner-provided PoE networked switch.
    4. The Division 8 Contractor is responsible for providing the following:

a. Final terminations of all internal wiring of electrified door hardware and door power supply connections.

b. Final terminations from the door power supply or relay board up the power transfer hinge or similar connection point of the electrified door hardware.

M. Access Control System Power Supplies

1. Unless otherwise noted, all power supplies shall be hardwired to the 120VAC circuit. No pigtails / plugs shall be acceptable.

2. Enclosed Wall Mounted Access Control Panel Power Supply

a. The Security Contractor shall provide and install devices as indicated on the drawings.

b. Security Contractor shall refer to Division 8 Finish Hardware schedules and system requirements for sizing and quantity of boards in the enclosed power supply.

c. The Security contractor shall provide dual voltage power supply board as specified.

d. The Security Contractor shall provide and install Power Control Modules as specified.

1) Each Lock power output cable shall be terminated to a dedicated port on the Power Distribution Module specified.

e. The Security Contractor shall provide and install Power Distribution Modules as specified.

1) Each request-to-exit motion (where required) cable shall be terminated on a dedicated port on the Power Distribution Module.

f. The Security Contractor shall size each enclosure(s) with dual voltage power supplies as specified to include an additional total amperage of at least for 20% additional maximum amperage output per enclosure for future expansion as required.

g. The Security contractor shall provide (2) back up batteries as specified per each enclosure.

h. 115VAC hardwired power shall be provided and installed by Division 26 Electrical Contractor.

i. 30Amp dedicated circuit shall be provided and installed by the Division 26 Electrical Contractor.

j. Provide U.L. Listed power supplies for all Access Control System panels as specified.

k. Provide battery chargers and batteries for all power.

l. Monitor low battery and power fail alarms for each power supply.

m. Tampers shall be wired as recommended by the manufacturer.

3. Backup Battery(s)

a. The Security Contractor shall provide and install (2) batteries per power supply enclosure.

b. The Security Contractor shall label the install date for each battery with printed labels.

N. Access Control Cabling

1. Pathways

a. Wires shall be routed utilizing the pathways as indicated in the technology drawings. Reference Division 27 specifications for additional requirements.

b. Access control cabling shall be routed separate from the network data communication cables specified in Division 27. Contractor shall provide separate pathways and j-hooks for the cables specified herein.

2. Wiring Techniques

a. All cables shall be pre-tested for shorts prior to final device terminations after cables are installed.

b. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored in the provided enclosure(s) as detailed in the drawings. If an enclosure is not provided for the specified devices herein, the service loop shall be installed on a j-hook in the nearest accessible ceiling space closest to the device.

c. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored at the access control panel.

d. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored on the wall above the ladder rack in the regional MDF / IDF / Mechanical room(s).

e. Install code compliant fire proofing techniques for all penetrations of fire rated partitions and slabs, where the penetrations are made by or used for installation of the ACS.

f. All wire and cable shall be continuous from device location to the final point of termination (“Home Run”). No mid-run cable splices shall be allowed.

g. Wire and cable within control panels, power distribution cabinets and other security enclosures shall be neatly installed, completely terminated, pulled tight with slack removed and routed in such a way as to allow direct, unimpeded access to the equipment within the enclosure. All wire and cable shall be bundled and tied. Velcro cable ties shall be utilized.

h. Neatly bundle and wrap all horizontal / vertical runs (above accessible ceilings and not within conduit) wire and cable at intervals as code requires. Provide supports as required. All supports shall be UL listed for the application.

i. All system wiring within vertical riser shafts (as required) shall be bundled, wrapped, and tied to the structure at one-meter intervals in order to isolate it from other wire and cable within the shaft. Additionally, all wire and cable within the shaft shall be supported at least every two floors using manufacturer approved vertical management hardware and installation methods. Provide all personnel and equipment necessary to install and support the cable. All equipment shall be UL listed for the application.

j. Provide grommets and strain relief material where necessary to avoid abrasion of wire and excess tension on wire and cable.

3. Splices / Transitions

a. Home run cabling is the preferred method of installation for all Access Control System devices and panels.

b. In the unlikely event that a splice or transition is required, the Contractor shall identify all splices / transition points required for the completion of the project and confirm, in writing, in advance, via RFI with the Architect / Design Consultant for acceptance of the proposed wiring techniques to be utilized.

c. By not submitting an RFI, Contractor acknowledges that no major splicing is required for the completion of this project. Any splices not previously identified that are found to be faulty shall require the Contractor to re-install the affected cable in its entirety at no cost to the Owner.

d. Contractor shall clearly mark splices / transition points on the shop drawings and As-Built drawings as part of the project close-out.

4. Cable Dressing

a. No excessive cable slack shall be left in enclosures.

b. Cables shall be dressed in a professional manor

c. Cables shall be routed in 90-degree angles to termination points inside enclosures.

d. Ty raps / zip ties are not permitted, hook and loop / Velcro is acceptable.

e. Exposed wires are not acceptable

f. Enclosures and equipment / Telecommunication room shall be left clean without debris including but not limited to: labels, connectors, screws, etc.

g. All spare / unused cables shall be in the enclosure shall be neatly coiled and protected to avoid any shorts to ground.

O. Device Labeling

1. Unless otherwise, all installed devices shall be labeled. Contractor shall verify device numbering scheme and Owner's current naming convention standard in writing in advance via RFI prior to generating any labels.
2. All labels shall be machine printed and adhered to the device in a location that is visible and legible to the naked eye.
3. All labeling in the field shall match the same labeling scheme in the closeout documents.
4. Refer to Div. 27 specifications for data network device cabling requirements.
5. Cables overall sheath shall be labeled within (6) inches from the point the cable enters/exits the enclosure inside the Equipment Room / Telecommunications / Security Control Location Rooms.
6. Cables shall be labeled within (1) inch from the termination point inside the Equipment Room / Telecommunications / Security Control Location Rooms.
7. Cables shall be labeled within (1) inch from the termination point at the device end.
8. Cables shall be labeled identically at both ends.

P. Fire Stop / Smoke / Sound Sealants

1. Use proper sealant as recommended by the manufacturer for the specific application in compliance with per all applicable codes: City, State, Federal, LAHJ.
2. All existing pathways shall be resealed in compliance with per all applicable codes: City, State, Federal, LAHJ.

Q. Grounding and Bonding

1. All grounding and bonding shall be performed by a licensed electrical contractor to ensure the electrical integrity of the low voltage system and devices specified herein per federal / state / local codes and standards.
2. Contractor shall notify the Architect / Owner / Design Consultant via written RFI of any site conditions or installations that will require additional coordination.
3. Contractor shall ensure proper grounding of shielded or non-shielded cabling and devices conform to the specified devices manufacturer's installation guidelines.
4. The Division 28 Contractor is responsible for coordinating with the Division 26 Contractor for grounding and bonding security devices per applicable codes and standards.

R. Conduit, Boxes and Raceways (For Reference Only - By Division 26)

1. Install all conduit necessary for a complete installation, but not provided for in the Security Drawings, in finished areas concealed in chases, furring's, concrete slabs and/or above suspended ceilings. No exposed conduit shall be installed within public areas.
2. Conduit shall be carefully installed, properly and adequately supported as required to comply with the requirements outlined herein and as required by the NEC to provide a neat, industry-standard installation. Horizontal conduit runs shall be supported by clamps, pipe straps, special brackets, or heavy iron tie, tied to the black iron structural members supporting the ceiling. Fastening of conduit to masonry walls, floor or partitions require malleable pipe clips with screws and suitable expansion sleeves.
3. All conduits shall be cut accurately to measurements established at the building and shall be installed without springing or forcing.
4. All required inserts shall be drilled-in and all openings required through concrete or masonry shall be saw cut or core drilled with tools specifically designed for this purpose.
5. Swab out and remove all burrs from conduit before any wires are pulled.
6. Lay out and install conduit runs as to avoid proximity to hot pipes. In no case shall a conduit be run within 75 mm of such pipes, except where crossings are unavoidable and then the conduit shall be kept at least 25 mm from the covering of the pipe crossed.
7. Provide fire stops where conduits penetrate fire rated walls and/or floors.

8. All conduit installation, whether run exposed or concealed, shall be approved prior to installation by the Architect.

S. Access Control System Programming And Data Entry

1. Provide all initial system programming and setup of the ACS including, but not limited to the following:

a. The Contractor will be provided access to the OFOI server for “general” programming. The Contractor shall provide for the following “general” programming of the access control system. Fort Bend ISD will then complete the detailed programming.

1) Naming of all doors

2) General access level at all doors

3) General access level is all doors are locked 24/7/365.

T. High Voltage (120VAC) Power Requirements (For Reference Only – by Division 26)

1. 120VAC AC power dedicated to security shall be provided by the electrical contractor for the Access control system as indicated on drawings. Coordinate with the Architect to establish locations of security dedicated 120VAC AC circuits.

2. Connect to the AC power (provided by electrical contractor) and provide UL listed power supplies and transformers to distribute low voltage power to the system components as required.

3. Provide all conduit and wiring from the AC power facilities to the Access Control / Power Supply Enclosures.

4. Provide Mechanical separation to isolate 120VAC wires from other low voltage cabling. Low voltage cabling shall not route over/under/parallel to 120VAC wires.

U. Surge Protection / Lightning Arrestors

1. Protect all exterior devices, control, power, signal cables and conductors that are power surges. Each surge protector shall be UL Listed.

2. Unless otherwise noted, surge protection devices shall be installed at both the edge and head end of the cabling run.

3. Surge devices shall be installed as close as accessibly possible to the equipment they are protecting.

4. Surge Protection shall be properly installed in an accessible ceiling or enclosure space to allow for cable removal during troubleshooting.

5. Include surge protection device locations on as-builts and shop drawings.

6. Provide protection against spikes, surges, noise, and other line problems for all system equipment and components.

7. Properly ground surge protection devices per the manufacturer installation requirements.

3.5 TESTING REQUIREMENTS

A. As a prerequisite, the Contractor shall perform a burn-in of the system that is in accordance with the manufacturer’s installation guidelines.

1. All devices shall be powered up and tested in a phased approach in a controlled testing environment on or off premise (to be coordinated with the Owner).

2. Update firmware with most up to date version (to be coordinated with the Owner).

B. Each system hardware device shall remain operational during the burn-in test for a minimum of eight (8) hours without failure.

1. Contractor shall provide successful burn-in results in writing to the Architect / Design Consultant prior to final acceptance.

C. Security Contractor shall conduct a complete QA/QC test of the entire system and provide a written report of the test results (Punchlist). The tests shall include, but not limited to:

1. Hardware

2. Software
3. Network Connectivity
4. Device Power
5. Configure system device settings

D. Identify and remediate any issues and/or system faults

E. It is the responsibility of the Contractor to verify that all devices, equipment, software, interfaces, sub-system interfaces and integrations are fully functional and operational.

F. Contractor shall rectify all issues discovered during the QA/QC process and shall document these corrections via a Contractor provided punch-list.

1. At a minimum, the punch-list shall contain:
   a. Date of the item identified
   b. Description of the discrepancy with photographs, as necessary.
   c. Date the item was rectified

G. All QA/QC items shall be corrected, and an electronic report surrendered to the Architect / Design Consultant prior to calling for Substantial Completion.

3.6 TRAINING REQUIREMENTS

A. Provide for (4) hours of training for two (2) persons on each system.

B. Provide a test report showing the system has been 100% tested and 100% operational prior to training / demonstration.

C. Coordinate with the Owner to establish a training outline and schedule. Submit a comprehensive training curriculum to the Owner once all preliminary coordination is complete. The Owner will revise and comment on the curriculum as required.

D. Contractor training shall be conducted onsite/virtually with a manufacturer’s representative in attendance.

E. Operator training shall include, but not be limited to the following:

1. All operating procedures and graphic user interface (GUI)
2. System configuration
3. Alarm acknowledgement, alarm response logging, and map graphics functionality
4. Image capture, badge printing, and print ribbon replacement.

F. Administrative training shall include, but not be limited to the following:

1. All operating system procedures, configuration variables and graphic user interface (GUI)
2. Database functions and setup
3. Cardholder input and deletion procedures
4. Report generation
5. Card format configuration
6. Badge creation and design

G. Record, label, and catalog all training on DVD and “user’s manual” written specifically for the Owner personnel onsite, for daily routine operations of the systems. Provide the DVD and user’s manual to the Owner for future in-house training sessions and / or reviews. Furnish all temporary equipment necessary for recording all training sessions. Maintain accurate and up-to-date time sheets of all training sessions.

H. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested until the total number of training hours has been completed.

3.7 FIELD OBSERVATIONS

A. A minimum of ten business days in advance, Contractor shall notify the Design Consultant and Owner as to the readiness for a Field Observation for the following at a minimum but not limited to:

1. Rough-In Observation – after conduits have been installed, but before walls have been installed.
2. Above Ceiling Observation – after cabling has been installed, but before ceilings have been installed.
3. Final Site Observation – a minimum of two weeks before Substantial Completion.

B. During Design Consultant's Final Site Observation of the installed systems, provide a minimum of one factory-trained/certified technician on the operation of all installed systems for up to (1) 8-hour day to assist with Design Consultant's functional testing.

C. Non-Conforming Work (Punch-List)

1. After receipt of written notice of deficiencies (Punch-List), Contractor shall correct all defective work within ten business days. If the work has been identified to be corrected by the Architect/Design Consultant, the Contractor shall remediate it in conformance with the contract documents at no cost to the Owner.

3.8 SUBSTANTIAL COMPLETION

A. It is the responsibility of the Contractor to ensure that all punch list items are 100% complete. The Contractor shall complete an internal Quality Assurance / Quality Control inspection, make all corrections, document the deficiencies and corrections prior to requesting for any further inspections with the Architect / Owner / Design Consultant.

B. Prior to any Substantial Completion, the Contractor shall submit a minimum two sets of preliminary (first draft) Record Drawings (As-Builts) to the Architect/Design Consultant. The preliminary Record Drawings are to be used by the Architect/Design Consultant to conduct the system substantial completion inspection.

C. The Contractor shall notify the General Contractor / Architect / Design Consultant that all the items noted above have been completed and the installation is ready for inspection.

D. The Architect / Design Consultant shall schedule an inspection of the installation with the General Contractor and the Installing Contractor(s) present.

E. The Substantial Completion Inspection shall consist of the following:

1. The Project Manager/Superintendent and Installation Technician shall be on site with all tools, materials, and equipment ready to resolve any minor issues identified.
2. The Design Consultant or designated representative shall visually inspect the installation in accordance with the official design documents.
    a. The Contractor shall be prepared to remove and reinstall (minimum 10%) randomly selected security devices to inspect the mounting, cabling, terminations, connectors, labeling, tampers.
3. Punch list items shall be identified and documented in a provided punch list with a date and description of the issue found, and a date the discrepancy was addressed and the resolution.

F. Provide all personnel, equipment, and supplies necessary to perform all site testing. All video surveillance cameras shall be pointed and aimed in the views as shown in the drawings and using best practices. Contractor shall provide a minimum two employees to verify all cameras have been pointed and aimed to achieve Owner final approval. A manufacturer's representative may be present on site to answer any questions that may be beyond the technical capability of the Contractor's employees, if the Contractor so elects or by specific request of the Architect or Owner, at no charge to the Architect or Owner.

G. The Contractor shall coordinate with the Architect/Design Consultant on security related construction clean-up and patch work requirements. Security equipment closets and similar areas should be free of accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, remove all waste materials, rubbish, the Contractor's and its subcontractors' tools, construction equipment, machinery, and all surplus materials.

H. At their discretion, if the Design Consultant or their designated representative deems the site not ready for inspection/observation, the inspection will be cancelled. The Contractor(s) shall

immediately address all issues identified, and shall reschedule the inspection in a timely manner so as not to affect the overall construction schedule.

I. Adjustments and Documentation: energizing and testing the systems, make adjustments and document the setting of controls, configurations, as applicable. Tabulate all data along with an inventory of test equipment, a description of testing conditions and a list of test personnel.

J. Test Documentation: Create and provide complete test reports documenting the results of the each performed on each device, control panel, power supply, and other elements of the system. Copies of preliminary test data shall accompany copies of performance testing data as part of the Operating and Maintenance submittal.

3.9 PROJECT CLOSEOUT DOCUMENTATION

A. As-Built Drawings

1. Drawings shall be provided to the Architect / Owner / Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect / Owner / Design Consultant.

2. Unless otherwise requested, Contractor shall provide digital copies of close-out documents, and deliver to the Architect / Owner / Design Consultant electronically.

3. As-Built drawings shall be produced in AutoCAD/Revit in the most current or compatible version and provided electronically in .dwg and/or .pdf format.

4. Drawings shall be provided in the original size as issued by the Architect / Design Consultant.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect / Design Consultant.

6. Provide a conformed set of Drawings as related to the project, depicting the condition of the access control system as installed to include but not limited to:

a. ASI, PR, and Addendum items installed throughout the duration of the project.

7. Provide a hard copy of the conformed set of drawings to be physically stored at the end of the project in a designated Access Control System enclosure. Coordinate with Owner for final storage location.

8. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of the following not limited to:

a. Access Control System Riser / Signal Flow Diagrams

b. Access Control System Backboard Layouts

1) To include access control boards, power supplies, pathways, etc.

c. Sleeves, Backbone Cabling and Communication pathways

d. Access Control System device locations and labeling scheme.

B. Operation Maintenance Manuals

1. Unless otherwise noted, provide O M manuals electronically to Owner to include all drawings, product datasheets, hardware manuals as related to the project.

2. Coordinate with the Owner for provisioning of physical storage devices (Hardcopy, Flash Drive, CD/DVDs)

C. Manufacturer’s Product Warranty

1. Certificate of product warranty shall be provided to the Architect / Owner / Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect / Design Consultant.

2. The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.

3. One original and two copies of the Manufacturer’s product warranty shall be provided.

D. Contactor’s Statement of Warranty

1. Statement of warranty shall be provided to the Architect / Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect / Design Consultant.
2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.
3. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e., Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION 2 13

SECTION 2 16 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section identifies the requirements, technical design, and specifications for the intrusion detection system at the Fort Bend ISD George Bush High School Renovations And Additions located in Richmond, Texas (“Owner”). The intrusion detection system as specified is an industry-standard that shall be an extension of the district’s existing intrusion system and includes keypads, motion detectors, door contacts, control panels, power supplies, and intrusion detection cabling as specified.

B. It is the Contractor’s responsibility to review this specification and associated project specifications and drawings in their entirety, prior to bidding on the project. By bidding on this project, the contractor acknowledges that they have read and fully understand these specifications, with no exceptions. Contractor shall review the drawings, specifications, and existing conditions prior to bidding on the project. Any discrepancies shall be brought to the attention of the Architect / Design Consultant via request for information (RFI) in writing for evaluation and or clarification. If these items are not brought to the attention of the Architect / Design Consultant the more costly or difficult manner, and the better quality or greater quantity of work shall be provided by the contractor in accordance with the Architect's / Design Consultant’s interpretation at no additional cost to the owner.

C. Contractor shall furnish and install all materials, equipment, and labor necessary to provide a complete and functional turn-key intrusion detection system regardless of any items not listed or described in this specification or associated drawings.

1.2 RELATED SECTIONS

A. Section 26 00 00 – Electrical

B. Section 26 09 00 – Lighting Controls

C. Section 27 10 00 – Structured Cabling System

D. Section 28 13 00 – Access Control System

1.3 REQUIREMENTS INDEX

A. Contractor Experience Requirements

B. Submittal Requirements

C. Products – General Requirements

D. Acceptable Manufacturers

E. Codes, Standards and Regulations

F. General Requirements

G. Coordination Requirements

H. System Requirements

I. Testing Requirements

J. Training Requirements

K. Project Closeout Documentation

1.4 CONTRACTOR EXPERIENCE REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 28 and shall be complied with in every respect. The Contractor shall examine all the items which make up the Contract Documents and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall be a certified Honeywell Vista Preferred Partner prior to submitting a bid for the work.

2. The Contractor shall possess all relevant Manufacturer Certifications (i.e., intrusion detection systems, hardware installation, software installation and programming) for both the company and individual technicians prior to submitting a bid for the work.
3. The Contractor shall have a manufacturer certified technician onsite throughout the duration of the installation phase of the project.
4. The Contractor's Project Manager shall be dedicated to this project for the duration of the project and shall be available for all onsite coordination meetings.
5. The Contractor shall have been in business for a minimum of five (5) years.
6. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.
7. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.
8. Licensed in the State of Texas.
9. Contractor is responsible for procuring all applicable intrusion detection permits required for this project with Fort Bend County / Fire Marshall.

C. Submitting Contractor must be certified to install products and services for systems they are proposing. No subcontract of services will be allowed for any security scope of work. Contractor must submit to the Owner prior to starting any work the factory training certifications for all personnel that will be working on the system.

1.5 SUBMITTAL REQUIREMENTS

A. Bid / Proposal Submittal

1. Contractor shall provide as part of their bid/proposal:
   a. Breakdown of proposed parts and labor required for the completion of the project.
   b. Proposed construction schedule in a Gant chart format
   c. Detailed Safety Plan
   d. Detailed documentation of QA / QC
   e. A detailed description of the installation team(s) that would perform the work.
   f. A resume for each of the key project personal.

B. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect / Design Consultant.
2. The Contractor is responsible for notifying and obtaining written approval via RFI from the Architect / Design Consultant / Owner of any proprietary devices, software, and/or installation processes.
3. Contractor is responsible for obtaining permitting as required in accordance with the authority having jurisdiction (AHJ), local, city, state, federal, and/or applicable law requirements.
4. Contractor shall ensure submittals are submitted in 10 business days to ensure all products can be ordered and received on site in order to not cause any delays. Any products having long lead times (more than 60 days) that may negatively impact the schedule shall be clearly identified in writing so the review and approval can be expedited.
5. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e., product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.
6. Contractor shall provide the following as part of their submittal:
   a. Manufacturer product data sheets for each proposed system component.

1) For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified will not be approved.

2) Contractor shall identify any products that are discontinued, end of life, or near end of life, and shall propose equal alternate to the discontinued product in writing.

b. Manufacturer Product Certifications for Company.

c. Manufacturer Product Certifications for Installers.

d. Manufacturer Warranty letters.

e. Documentation indicating that Contractor has been in business for (5) years.

f. Address of Contractor's local office within a 75-mile radius of the project site.

g. Quantity of full-time, local technicians within a 75-mile radius of the project site.

h. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

i. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

j. List of subcontractors performing any work on the project. List shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

k. Manufacturer's certification letter confirming that the proposed intrusion detection system components do not have any known cybersecurity notices, bulletins, or alerts. If a vulnerability is discovered, the contractor shall notify the Architect / Design Consultant within 24 business hours. Provide the make and model of the associated equipment and the vulnerability.

l. Manufacturer cybersecurity hardening guide. If one is not available, provide documentation from the manufacturer stating such.

m. A complete set of shop drawings to include at minimum but are not limited to:

1) Device locations

2) Cable Type and Pathways

3) Panel Termination Schedule

4) Elevation Drawings to illustrate the associated devices and the heights at which they will be installed.

5) Naming Convention Information

6) Signal Flow Diagram including full topology.

n. Supplemental documents to include but not limited to:

1) Safety Plan

2) Contractor QA/QC Document

3) Construction Schedule in a Gant chart format

4) Contractor Cybersecurity Hardening Guide

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Unless otherwise stated, all software and licensing shall be for the most current, up to date version of the system provided. For existing systems, Contractor shall obtain written verification of the Owner's most current software version and notify via RFI the Architect / Design Consultant / Owner if implementation of the most current software / license version will require an upgrade to the Owner's existing system.

C. Architect / Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

D. Proposed equivalent items must be approved in writing by the Architect / Design Consultant prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

E. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall submit a formal RFI for an appropriate substitute.

F. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished at no additional cost to the owner.

G. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

H. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect / Design Consultant which certifies performance characteristics and compliance with ANSI/TIA/EIA 568-C standards where applicable.

J. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect / Design Consultant. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues, and the Contractor will have all products on-site when needed to complete the job as per the project schedule.

K. Quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a fully functional system. Where quantities are not noted, they may be obtained from the drawings.

L. All software, hardware, and equipment (from the date of RFP) shall be tested, currently available and commercially off the shelf product. (COTS).

M. Written approval must be obtained from the Owner / Architect / Design Consultant for any proprietary or custom software and/or equipment prior to the beginning of the project.

2.2 ACCEPTABLE MANUFACTURERS

A. Control Panels

1. Honeywell/Ademco, VISTA-250BPT - (Primary Communication via Network)

B. Modules

1. Intrusion Communicator (ABS), Cellular (Back-up) – Owner Furnished / Contractor Installed
   a. StarLink SLE-LTEV
2. Honeywell/Ademco Eight- one Input Expander
   a. VISTA 4208U
3. Intelligent Relay Board – Lighting Controls
   a. Ademco 4204
4. V-Plex Single Output Relay Module
   a. Ademco 4101SN

C. Enclosures

1. Honeywell/Ademco (Sized as Required)
   a. Tamper Switch

b. Lock and Key

D. Power Supplies/Charger/Battery Backup

1. Enclosed Altronix AL Series
2. Or approved equal

E. Power Distribution Module Board

1. Enclosed Altronix PD8
2. Enclosed Altronix PD4
3. Or approved equal

F. Battery

1. Yuasa np7-12
2. Or approved equal

G. Keypads

1. Honeywell/Ademco Alpha Keypad, Vista 6160

H. Motion Detectors

1. Bosch Panoramic 360 Ceiling 60’ Motion Doctor Detector, Part Number DS938
2. Bosch Panoramic 360 Ceiling 25’ Motion Detector, Part Number DS936
3. Bosch TriTech 60x60 PIR Microwave Motion Detector, Part Number DS860
4. Bosch TriTech Long Range PIR Detector Part Number DS720

I. Motion Detector Cage - (All devices in gyms)

1. 7 in H x 5.75 in W x 4.5 in D – Part Number STI-9621
2. 12 in H x 12 in W x 8 in D – Part Number STI-9731
3. Or approved equal

J. Door Contacts

1. Recessed SPST
   a. GRI 180-12
   b. GRI 195-12 (DPDT)
   c. Or approved equal
2. Surface Mount with armored cable
   a. GRI- 4402-A
   b. GRI 4405-A (DPDT)
   c. Or approved equal
3. Overhead Door Position Switch
   a. Amseco ODC-59A

K. Duress Button

1. USP HUB2SA - Momentary

L. Siren

1. Self-Contained Dual Tone Surface Mount Siren

a. SS-2

M. Intrusion Detection Wiring

1. Lake Cable, Color Orange and Plenum Rated (Cable shall be sized based on length)
   a. Keypad – 18 AWG / 4-Conductor
      1) Lake Cable Part : P184C
      2) Or approved equal
   b. Motion Detectors - 18 AWG / 4-Conductor
      1) Lake Cable Part : P184C
      2) Or approved equal
   c. Door Contract – 22 AWG / 2-Conductor
      1) Lake Cable Part P222C
      2) Or approved equal
   d. Duress Button - 18 AWG / 4-Conductor
      1) Lake Cable Part : P184C
      2) Or approved equal
   e. Siren – 18 AWG / 2-Conductor
      1) Lake Cable Part : P182C
      2) Or approved equal
   f. Intelligent Relay Board (Lighting Controls) – 18 AWG / 6-Conductor (Coordinate FBISD cable color for Lighting Controls)
      1) Lake Cable Part : P186C
      2) Or approved equal
   g. Communication Cable
      1) Lake Cable Part : P184C
      2) Or approved equal

N. Pathway Cable Support

1. Panduit J-Mod Cable Support System
2. Erico – CADDY CAT LINKS J-Hook Series
3. Panduit Plenum Rated Hook Loop (Plenum Rated, Black)

O. Labeling

1. Permanent Labels for Copper Cables
   a. Panduit Self-Laminating Labels

P. Fire Stop

1. STI Spec Seal
2. 3M Products

PART 3 - EXECUTION

3.1 CODES, STANDARDS, REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition
2. Outside Plant Design Reference Manual 5th Edition
3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling
5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998
2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
3. FCC Part 76, Cable Television Service, revised 1998

F. Insulated Cable Design Consultants Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Design Consultants, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive
3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code
5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

I. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
3. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999
4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
5. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

J. National Cable Television Association (NCTA)

K. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

L. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code
2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
3. NFPA-101, Life Safety Code
4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

M. National Institute Standards and Technology (NIST)

N. Occupational Safety and Health Administration (OSHA)

O. Security Industry Association (SIA)

P. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA-568.0-D-1, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
4. ANSI/TIA-568.3-D-1 Optical Fiber Cabling Components Standard.
5. ANSI/TIA–569-D-2, Commercial Building Standard for Telecommunications Pathways and Spaces.
6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
7. ANSI/TIA-607-D, Commercial Building Grounding and Bonding Requirements for Telecommunications
8. ANSI/TIA-758-C, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

Q. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
2. RUS Bull 1751F-643 (2002) Underground Plant Design
3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)
6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)
7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)
8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

R. Underwriters Laboratories, Inc. (UL)

1. UL 294 Standard for Access Control System Units
2. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Access Control Systems and Equipment
3. UL 109 Standard Method for Flame Tests of Flame-Resistant Fabrics and Films

4. UL 1076 Standard for Proprietary Burglar Alarm Units and Systems

3.2 GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect / Design Consultant for direction before proceeding with that part of the work.

B. Contractor shall meet the specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines. Equipment and materials installed by the Contractor shall be free of defects and damage.

D. No deviations from the plans, details or specifications shall be made without full consent in writing of the Architect / Design Consultant. The Contractor shall have written approval from the Architect / Design Consultant for any additional work beyond the Contract Documents prior to beginning such work.

E. In the event site conditions do not allow the contractor to follow the execution requirements specified herein or in the provided details, the Contractor shall submit via RFI an alternative means and methods that is approved in writing by the Architect / Design Consultant.

F. The Contractor shall obtain written permission from the Architect / Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to: girders, beams, floors, walls, roofs, and/or ceilings.

G. If the Contractor does not obtain written approval from the Architect / Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

H. Contractor shall notify the Architect / Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect / Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

I. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

J. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

K. Contractor shall test all cables prior to and post installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

L. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect / Design Consultant.

M. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

N. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

O. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect / Design Consultant.

P. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

Q. Devices installed in public spaces shall be mounted and secured using tamper-proof security fasteners unless otherwise noted.

R. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

S. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

T. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

U. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

V. The manufacturer and contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owners technology infrastructure. These measures shall include but are not limited to:

1. The contractor shall scan contractor owned equipment for cyber threats such as viruses, malware, ransomware, etc., prior to connecting the contractor owned devices to the Owners network.
2. Ensure all technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics, i.e., servers, and other associated equipment.
3. All project documents shall be properly securely stored behind encryption and password protection to avoid unauthorized distribution of documents.

W. Labeled Doors and Frames

1. In no instance shall any UL labeled door or frame be drilled, cut, penetrated, or modified in any way.
2. The Contractor shall be responsible for replacing any labeled door or frame that is modified without written approval from the Architect.

3.3 COORDINATION REQUIREMENTS

A. The Contractor is responsible for the coordination of the following items and their respective disciplines included but not limited to.

B. Coordinate with the Architect to ensure that:

1. Adequate conduit is provided and that equipment backboxes are adequate for system installation.
2. Adequate power has been provided and properly located for the security system equipment.
3. Doors and door frames are properly prepared for electric locking hardware and door position switches.
4. Access hatch locations (when required) shall be submitted in writing via RFI and coordinated with the Architect.
5. Finishes and colors of all equipment visibly installed in public areas. Submit all finish and graphics for all equipment to the Architect for approval prior to installation.

C. Coordinate with the Division 8 contractor for the following:

1. Door hardware manufacturer installation, power, and ADA requirements.

D. Contractor is responsible for coordinating with gate controller installers for controller locations and interfacing terminations.

E. Coordinate with the Division 26 contractor for the following:

1. High voltage power pathways, grounding, and bonding requirements.
2. Drive up pedestal pathways to the interior of the building.
3. Pathways, rough ins, back boxes, and conduit sizes for all intrusion detection peripheral devices.

F. Coordinate with the Division 27 contractor for the following:

1. Installation and power requirements of network infrastructure associated to the specified Intrusion detection System
2. Associated patch cable lengths and quantities required for the specified Intrusion detection System

3. Location, power, and backup requirements for rack mount equipment.

G. Coordinate with the Division 28 (Fire) contractor for the following:

1. Requirements associated with fire alarm system(s).

H. The Contractor is responsible for coordinating intrusion detection locations and mounting preferences of all specified security devices with the Architect / Design Consultant prior to installation.

I. The Contractor is responsible for coordinating all intrusion detection programming requirements with the Owner / Architect / Design Consultant.

J. The Contractor shall coordinate with the Owner for the following:

1. Naming Conventions of devices, controllers, doors, etc.

K. The Contractor is responsible for coordinating with the Lighting Controls Contractor for Arm, Disarm, and alarm controls.

3.4 SYSTEM REQUIREMENTS

A. Provide equipment as indicated on the drawings and specified herein. Additional specific installation requirements are as follows:

1. The Intrusion detection System control panels, zone expanders, motion sensors, door contacts, intrusion detection cabling, and all other peripheral components as indicated on the drawing and specified herein.

2. Any devices associated with the installation shall have the latest firmware updates downloads via owner approved secure link from the system software and/or remotely from the manufacturer.

3. All Intrusion detection software, equipment and system requirements shall be installed per their respective Manufacturer Installation Guidelines.

B. Control Panel

1. The Control panel shall be the main point of programming, monitoring, accessing, securing, and troubleshooting the IDS.

2. The Control Panel shall be wall mounted in the “SR” room(s).

3. The Control Panel shall provide a means contact FBISD Dispatch via a Cellular communicator interface.

4. The Control panel shall utilize a Multifunctional Keypad, Input and Output Modules for expansion of alarm zones, interfacing with additional security subsystems, programming, monitoring, and controlling the IDS.

5. Control Panel cables shall be neatly routed with slack and each cable shall have printed labels 6-inches from each end.

6. Control Panel spare cables shall be securely tucked away with slack, clearly labeled and with all cable ends capped.

7. Every motion sensor shall be monitored via Power Distribution Module individually fused to protected outputs as required.

8. Control Panel shall be powered by a hardwired wall mounted UL listed power supply.

9. Auxiliary Power Output:

a. 9.6VDC-13.8VDC, 750mA max.

b. For UL installations, the accessories connected to the output must be UL Listed, and rated to operate in the above voltage range.

10. Backup Battery is required

C. Input Modules

1. Eight-zone expander that allows the use of available expansion zones on the Intrusion Detection System.
2. Input Modules shall be wall mounted in the “SR” room(s) as required.
3. Every motion sensor shall be monitored via Power Distribution Module individually fused to protected outputs as required.
4. Input Modules shall be powered from an external DC power supply UL listed as required.
5. Shall be installed per manufacture’s guidelines.

D. Intelligent Relay Board (Lighting Controls)

1. Shall be mounted in the mechanical room in the Intrusion Control Panel location.
2. (1) 18/6 orange plenum cable shall be routed from intelligent relay board to the Lighting Controls Panel and leave 20 feet coiled at the Lighting Controls Panel.
3. Coordinate with the Lighting Controls contractor for the Lighting Controls to pick up the “armed, disarmed, and activated” status points of the Intrusion system.
    a. Interlock with security system to turn off all contactor controlled fixtures upon arming of system.
    b. Interlock with security system to turn on all contactor controlled fixtures upon intruder activation.
    c. Interlock with security system to enable partial lighting when system is first disarmed via contactor schedule.
    d. Intent is to have three inputs from security system: armed, disarmed and activated.
    e. The security integrator needs to provide 3 inputs from the intrusion panel for the three conditions noted in a, b, c. noted above.
4. Shall be installed per manufacture’s guidelines.

E. Power Supplies/Charger/Battery Backup

1. Provide U.L. Listed power supplies for all Intrusion Detection System equipment as specified.
2. Provide power supplies with battery chargers and back-up batteries.
3. Shall be installed per manufacture’s guidelines.

F. Power Distribution Module Board

1. Shall securely mounted be in UL listed enclosure.
2. Shall be installed per manufacture’s guidelines.

G. Battery

1. Shall securely mounted be in UL listed enclosure.
2. Batteries shall have the installation date clearly labeled with printed labels.
3. Batteries shall be on anti-static pads as required.
4. Shall be installed per manufacture’s guidelines.

H. Keypad

1. A multifunctional keypad shall be utilized as a user interface for arming, disarming, monitoring, troubleshooting, and programming the alarm control panel.
2. Orange plenum rated 18 AWG / 4-Conductor as required.
3. Shall be installed per manufacture’s guidelines.

I. Motion Detection Devices

1. The IDS shall consist of interior, exterior, and other detection devices that are capable of:
    a. Locating intrusions at individually protected asset areas or at an individual portal.
    b. Locating intrusions within a specific area of coverage.

c. Locating failures or tampering of individual sensors or components.

2. Provide and adjust for devices so that coverage is maximized in the space or area it is installed in. For large rooms where multiple devices are required, ensure device coverage is overlapping.

3. Detection sensitivity shall be set up to ensure maximum coverage of the secure area is obtained while at the same time limiting excessive false alarms due to the environment and impact of small animals. All detection devices shall be anti-masking with exception of video motion detection.

4. TriTech sensor technology shall be used when possible. Sensor technology shall not be of the same type that is easily defeated by a single method. This will reduce the amount of false alarms.

5. Environmental Conditions: Systems shall be able to operate in environmentally protected interior and/or exterior areas and shall meet operational performance requirements for the ambient conditions.

J. Panoramic 360 Ceiling Motion Sensors

1. Provide 360 Ceiling Motion Sensors as indicated on drawings to monitor movement and create alarm condition upon detection when device is armed.

2. Provide the manufacturer recommended power supply. The power supply shall be UL Class 2, power limited.

3. Every motion sensor shall be monitored via Power Distribution Module individually fused to protected outputs as required.

4. Ceiling Motion Sensors shall be mounted on drop tile as indicated on TS Typical Details sheets.

5. Orange plenum rated 18 AWG / 4-Conductor as required.

6. Shall be installed per manufacture’s guidelines.

K. TriTech Technology Motion Sensor

1. Provide TriTech technology motion sensors as indicated on drawings to monitor movement and create alarm condition upon detection when device is armed.

2. Provide the manufacturer recommended power supply. The power supply shall be UL Class 2, power limited.

3. Every motion sensor shall be monitored via Power Distribution Module individually fused to protected outputs as required.

4. TriTech Technology Motion Sensor shall be wall mounted as indicated on TS Typical Details sheets.

5. Orange plenum rated 18 AWG / 4-Conductor as required.

6. Shall be installed per manufacture’s guidelines.

L. Long Range Motion

1. Provide TriTech Long Range Motion technology motion sensors as indicated on drawings to monitor movement and create alarm condition upon detection when device is armed.

2. Provide the manufacturer recommended power supply. The power supply shall be UL Class 2, power limited.

3. Every motion sensor shall be monitored via Power Distribution Module individually fused to protected outputs as required.

4. TriTech Technology Long Range Motion shall be wall mounted as indicated on TS Typical Details sheets.

5. Orange plenum rated 18 AWG / 4-Conductor as required.

6. Shall be installed per manufacture’s guidelines.

M. Door Position Switches

1. Provide normally closed magnetic concealed door position switches, surface mount door position switches and overhead door position switches to monitor the open/closed status of doors as specified herein and as indicated on the drawings.

2. Provide armored cable (as required) from the switch location to the associated junction box in order to conceal the wire.
3. Orange plenum rated 22 AWG / 2-Conductor as required.
4. Shall be installed per manufacture's guidelines.

N. Duress Button

1. Shall be under desk mounted with flex conduit neatly secured to desk with security screws.
2. Orange plenum rated 18 AWG / 4-Conductor as required.
3. Shall be installed per manufacture's guidelines.
4. Duress Button shall call FBISD PD when in alarm mode.

O. Tamper Switches

1. The following IDS sensors shall be used to monitor and detect potential tampering of sensors, control panels and enclosures.
2. Tamper Switches: All enclosures including cabinets, housings, boxes, raceways, and fittings with hinged doors or removable covers containing circuits and power supplies related to the IDS shall include corrosion-resistant tamper switches.
3. Tamper alarms shall be annunciated to be clearly distinguishable from IDS alarms.
4. Tamper switches will not be in a viewable from a direct line of sight perspective. The minimum amount of time the tamper switch becomes active and sends a signal after an enclosure is opened or panel removable is attempted, shall be one (1) second.
5. Tamper switches will initiate when enclosure doors or covers is removed as little as 6.35 mm (1/4 inch) from the closed position unless otherwise indicated. Tamper switches shall be:
    a. Push/pull automatic reset type
    b. Inaccessible until switch is activated
    c. Spring-loaded and held in closed position by door or cover
    d. Wired to break a circuit when door or cover is removed
6. Fail-Safe Mode: Shall provide the capability to detect and annunciate diminished functional capabilities and perform self-tests. Fail-safe alarms shall be annunciated to be clearly distinguishable from other types of alarms.
7. Orange plenum rated 22 AWG / 2-Conductor as required.
8. Shall be installed per manufacture's guidelines.

P. Intrusion Detection Cabling - orange jacket (no exceptions)

1. Pathways
    a. Wires shall be routed utilizing the pathways as indicated in the technology and security drawings. Reference Division 27 specifications for additional requirements.
    b. Intrusion detection cabling shall be routed separate from the network data communication cables specified in Division 27. Contractor shall provide separate pathways and j-hooks for the cables specified herein.
2. Wiring Techniques
    a. All cables shall be pre-tested for shorts prior to final device terminations after cables are installed.
    b. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored in the provided enclosure(s) as detailed in the drawings. If an enclosure is not provided for the specified devices herein, the service loop shall be installed on a j-hook in the nearest accessible ceiling space closest to the device.
    c. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored at the intrusion detection panel.

d. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored on the wall in the regional mechanical room(s).

e. Install code compliant fire proofing techniques for all penetrations of fire rated partitions and slabs, where the penetrations are made by or used for installation of the ACS.

f. All wire and cable shall be continuous from device location to the final point of termination (“Home Run”). No mid-run cable splices shall be allowed.

g. Wire and cable within control panels, power distribution cabinets and other security enclosures shall be neatly installed, completely terminated, pulled tight with slack removed and routed in such a way as to allow direct, unimpeded access to the equipment within the enclosure. All wire and cable shall be bundled and tied. Velcro cable ties shall be utilized.

h. Neatly bundle and wrap all horizontal / vertical runs (above accessible ceilings and not within conduit) wire and cable at intervals as code requires. Provide supports as required. All supports shall be UL listed for the application.

i. All system wiring within vertical riser shafts (as required) shall be bundled, wrapped, and tied to the structure at one-meter intervals in order to isolate it from other wire and cable within the shaft. Additionally, all wire and cable within the shaft shall be supported at least every two floors using manufacturer approved vertical management hardware and installation methods. Provide all personnel and equipment necessary to install and support the cable. All equipment shall be UL listed for the application.

j. Provide grommets and strain relief material where necessary to avoid abrasion of wire and excess tension on wire and cable.

3. Splices / Transitions

a. Home run cabling is the preferred method of installation for all Intrusion detection System devices and panels.

b. In the unlikely event that a splice or transition is required, the Contractor shall identify all splices / transition points required for the completion of the project and confirm, in writing, in advance, via RFI with the Architect / Design Consultant for acceptance of the proposed wiring techniques to be utilized.

c. By not submitting an RFI, Contractor acknowledges that no major splicing is required for the completion of this project. Any splices not previously identified that are found to be faulty shall require the Contractor to re-install the affected cable in its entirety at no cost to the Owner.

d. Contractor shall clearly mark splices / transition points on the shop drawings and As-Built drawings as part of the project close-out.

4. Cable Dressing

a. No excessive cable slack shall be left in enclosures.

b. Cables shall be dressed in a professional manor.

c. Cables shall be routed in 90-degree angles to termination points inside enclosures.

d. Ty raps / zip ties are not permitted, hook and loop / Velcro is acceptable.

e. Exposed wires are not acceptable.

f. Enclosures and equipment / Telecommunication room shall be left clean without debris including but not limited to: labels, connectors, screws, etc.

g. All spare / unused cables shall be in the enclosure shall be neatly coiled and protected to avoid any shorts to ground.

Q. Labeling

1. Contractor shall verify room numbers and confirm the final room numbering scheme and Owner’s current standard in writing in advance via RFI prior to generating any labels.

2. Cables overall sheath shall be labeled within (6) inches from the point the cable enters/exits the enclosure inside the Equipment Room / Telecommunications / Security Control Location Rooms.

3. Cables shall be labeled within (1) inch from the termination point inside the Equipment Room / Telecommunications / Security Control Location Rooms.
4. Cables shall be labeled within (1) inch from the termination point at the device end.
5. Cables shall be labeled identically at both ends.
6. Label all controls as necessary to agree with their function.
7. All labeling in the field shall match the same labeling scheme in the closeout documents.

R. Fire Stop / Smoke / Sound Sealants

1. Use proper sealant as recommended by the manufacturer for the specific application in compliance with per all applicable codes: City, State, Federal, LAHJ.
2. All existing pathways shall be resealed in compliance with per all applicable codes: City, State, Federal, LAHJ.

S. Grounding and Bonding

1. The Contractor shall ensure metal-to-metal contact for all grounding terminations.
2. All materials shall be UL Listed.
3. All connections shall be made with UL Listed compression 2-hole lugs.
4. Contractor shall use an anti-oxidation compound on all connections.
5. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum 6 AWG plenum rated green insulated conductor.
6. A Grounding Equalizer conductor shall be installed when required by ANSI/TIA/EIA-607-B (Interconnects multiple TBBs on the top floor and every 3rd floor in between).
7. The connection to building steel does not eliminate the requirement for the TBB or EBC to the service ground.
8. Equipment Bonding Conductor (EBC)
    a. Contractor shall furnish and install a minimum 6 AWG plenum rated green insulated conductor from the TMGB or TGB as applicable to each ladder rack system, equipment rack, cabinet, metallic raceway, lightning protector, or multi-pair cable with a metallic element. Contractor shall use an anti-oxidation compound on all connections.
    b. When exceeding (13) feet the EBC shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil.

T. Conduit, Boxes and Raceways (For Reference Only - By Division 26)

1. Install all conduit necessary for a complete installation, but not provided for in the Security Drawings, in finished areas concealed in chases, furring’s, concrete slabs and/or above suspended ceilings. No exposed conduit shall be installed within public areas.
2. Conduit shall be carefully installed, properly and adequately supported as required to comply with the requirements outlined herein and as required by the NEC to provide a neat, industry-standard installation. Horizontal conduit runs shall be supported by clamps, pipe straps, special brackets, or heavy iron tie, tied to the black iron structural members supporting the ceiling. Fastening of conduit to masonry walls, floor or partitions require malleable pipe clips with screws and suitable expansion sleeves.
3. All conduits shall be cut accurately to measurements established at the building and shall be installed without springing or forcing.
4. All required inserts shall be drilled-in and all openings required through concrete or masonry shall be saw cut or core drilled with tools specifically designed for this purpose.
5. Swab out and remove all burrs from conduit before any wires are pulled.
6. Lay out and install conduit runs as to avoid proximity to hot pipes. In no case shall a conduit be run within 75 mm of such pipes, except where crossings are unavoidable and then the conduit shall be kept at least 25 mm from the covering of the pipe crossed.

7. Provide fire stops where conduits penetrate fire rated walls and/or floors.
8. All conduit installation, whether run exposed or concealed, shall be approved prior to installation by the Architect.

U. High Voltage (120VAC) Power Requirements (For Reference Only – by Division 26)

1. 120VAC AC power dedicated to security shall be provided by the electrical contractor for the Intrusion detection system as indicated on drawings. Coordinate with the Architect to establish locations of security dedicated 120VAC AC circuits.
2. Connect to the AC power (provided by electrical contractor) and provide UL listed power supplies and transformers to distribute low voltage power to the system components as required.
3. Provide all conduit and wiring from the AC power facilities to the Intrusion detection / Power Supply Enclosures.
4. Provide Mechanical separation to isolate 120VAC wires from other low voltage cabling. Low voltage cabling shall not route over/under/parallel to 120VAC wires.

V. Surge Protection / Lightning Arrestors

1. Protect all exterior or interior devices, control, power, signal cables and conductors that are power surges. Each surge protector shall be UL Listed.
2. Unless otherwise noted, surge protection devices shall be installed at both the edge and head end of the cabling run.
3. Surge devices shall be installed as close as accessibly possible to the equipment they are protecting.
4. Surge Protection shall be properly installed in an accessible ceiling or enclosure space to allow for cable removal during troubleshooting.
5. Include surge protection device locations on as-builts and shop drawings.
6. Provide protection against spikes, surges, noise, and other line problems for all system equipment and components.
7. Properly ground surge protection devices per the manufacturer installation requirements.

3.5 SYSTEM PROGRAMMING AND DATA ENTRY

A. Provide all initial system programming and setup of the IDS including, but not limited to the following:

1. Graphical maps and icons. Coordinate with the Architect to obtain AutoCAD/REVIT architectural backgrounds for implementation as graphical maps. Import all AutoCAD/REVIT background information provided by the Architect and produce a complete set of graphical maps depicting all IDS points.
2. IDS device information. Coordinate all device values and text, including descriptors, alarm messages, map call up and identification with the Architect.
3. Input and output points for the IDS. Coordinate all input and output priorities and text, including descriptors, alarm messages.
4. Contractor shall coordinate with FBISD Design Manager for zoning, global linking, and keypad requirements prior to programming Intrusion Detection System.

B. Enter all data needed to make the Security System operational. Deliver the data to the Owner on data entry forms, utilizing data from the Contract Documents, Contractor's field surveys and all other pertinent information in the Contractor's possession required for complete installation of the database. Identify and request from the Architect any additional data needed to make the Security System fully operational and integrated. The completed forms shall be delivered to the Owner for review and approval prior to the Contractor's scheduled need date.

3.6 TESTING REQUIREMENTS

A. Provide a test report showing the system has been 100% tested and in 100% operational prior to training / demonstration.

B. System Start-Up

1. The Work shall be complete and ready to operate prior to final acceptance.

2. The Architect shall assist in establishing procedural guidelines and in defining terminology and conditions unique to the Owner's operation.

C. Substantial Completion

1. In order to qualify for the Architect's consideration of Substantial Completion, the Work must, at a minimum, meet the following requirements:
   a. Installation of all devices must be completed.
   b. All sub-system interfaces must be complete and operational.
2. Substantial Completion shall not be misconstrued as final acceptance of the Work.

D. System Acceptance

1. Final acceptance testing of the Work will be conducted by the Architect.
2. Prior to any final acceptance testing, the Contractor shall submit two sets of preliminary (draft) Record Drawings to the Architect. The preliminary Record Drawings are to be used by the Architect to conduct the system final test.
3. Before system acceptance testing the Security Contractor shall conduct a complete in-house QA/QC test of the entire Intrusion detection System and provide a written report on the results of that test. During the QA/QC test the Security Contractor shall place the ACS in service mode and calibrate and test all equipment.
4. Following completion of the initial testing and correction of any noted deficiencies, conduct a five-day burn-in test. The intent of the burn-in test shall be to prove the Intrusion detection system by placing it in near real operating conditions. During this period, the Intrusion detection system shall be fully functional and programmed such that all points, interfaces, controls, reports, messages, prompts, etc. can be exercised and validated. Record and correct any system anomaly, deficiency, or failure noted during this period. Scheduling of the final acceptance test shall be based on a review of the results of this burn-in test.
5. Deliver a report describing the results of functional tests, burn-in tests, diagnostics, calibrations, corrections, and repairs including written certification to the Architect that the installed complete Intrusion detection system has been calibrated, tested, and is fully functional as specified herein.
6. Prior to the final acceptance test, coordinate with the Architect for security related construction clean-up and patch work requirements. Security equipment closets and similar areas should be free of accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, remove all waste materials, rubbish, the Contractor's and its subcontractors' tools, construction equipment, machinery, and all surplus materials.
7. Upon written notification from the Contractor that the Intrusion detection system is completely installed, integrated and operational, and the burn-in testing completed, the Architect will conduct a final acceptance test of the entire system.
8. During the course of the final acceptance test by the Architect, the Contractor shall be responsible for demonstrating that, without exception, the completed and integrated system complies with the contract requirements. All physical and functional requirements of the project shall be demonstrated and shown. This demonstration will begin by comparing "as built" conditions of the Intrusion detection system to requirements outlined in the Specification, item by item. Following the Specification compliance review, all Intrusion detection system head-end equipment will be evaluated.
9. The functionality of the various interfaces between systems will be tested.
10. Following the Intrusion detection system head-end equipment and console review, the installation of all field devices will be inspected. This field inspection will weigh heavily on the general neatness and quality of installations, complete functionality of each individual device, and mounting, backbox and conduit requirements compliance.
11. All equipment shall be on and fully operational during any and all testing procedures. Provide all personnel, equipment, and supplies necessary to perform all site testing. Provide a minimum of two employees familiar with the system for the final acceptance test. One employee shall be responsible for monitoring and verifying alarms while the other will be required to demonstrate the function of each device. Supply at least two two-way radios for use during the test. A manufacturer's representative may be present on site to answer any questions that may be beyond the technical

capability of the Contractor's employees, if the Contractor so elects or by specific request of the Architect or Owner, at no charge to the Architect or Owner.

12. Upon successful completion of the final acceptance test (or subsequent punch list retest) the Architect will issue a letter of final acceptance.

13. The Architect retains the right to suspend and/or terminate testing at any time when the system fails to perform as specified. In the event that it becomes necessary to suspend the test, all of the Owner's/Architect's fees and expenses related to the suspended test will be deducted from the Contractor's retainage. Furthermore, in the event it becomes necessary to suspend the test, the Contractor shall work diligently to complete/repair all outstanding items to the condition specified in the Specification and as indicated on the Drawings. The Contractor shall supply the Architect with a detailed completion schedule outlining phase by phase completion dates and a tentative date for a subsequent punch list retest. During the final acceptance test, no adjustments, repairs, or modifications to the system will be conducted without the permission of the Architect.

3.7 TRAINING

A. Provide for (4) hours of training for two (2) persons on each system.

B. Provide a test report showing the system has been 100% tested and 100% operational prior to training / demonstration.

C. Coordinate with the Owner to establish a training outline and schedule. Submit a comprehensive training curriculum to the Owner once all preliminary coordination is complete. The Owner will revise and comment on the curriculum as required.

D. Operator training shall include, but not be limited to the following:

1. All operating procedures

2. System configuration

3. Alarm acknowledgement, alarm response logging

E. Administrative training shall include, but not be limited to the following:

1. All operating system procedures and configuration variables

2. Report generation

F. Record, label, and catalog all training on DVD and "user's manual" written specifically for the school personnel onsite, for daily routine operations of the systems. Provide the DVD and user's manual to the Owner for future in-house training sessions and / or reviews. Furnish all temporary equipment necessary for recording all training sessions. Maintain accurate and up-to-date time sheets of all training sessions.

G. The Contractor shall be on call during the Warranty to answer any questions the Owner might have. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested by the Owner until the total number of training hours has been completed.

H. The Contractor shall be on call during the Warranty to answer any questions the Owner might have. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested by the Owner until the total number of training hours has been completed.

3.8 PROJECT CLOSEOUT DOCUMENTATION REQUIREMENTS

A. As-Built Drawings

1. As built drawings for the security systems must include model number, serial number, and installed location for each security device (i.e., keypad, motion sensor, door contact, etc.)

2. Electronic pdf as-built drawings will be required for final closeout. Close out drawings must include final installed locations, model numbers and serial numbers of all installed equipment.

3. Drawings shall be provided to the Architect / Owner / Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect / Owner / Design Consultant.

4. Unless otherwise requested, Contractor shall provide digital copies of close-out documents, and deliver to the Architect / Owner / Design Consultant electronically.

5. As-Built drawings shall be produced in AutoCAD/Revit in the most current or compatible version and provided electronically in .dwg and/or .pdf format.
6. Drawings shall be provided in the original size as issued by the Architect / Design Consultant.
7. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect / Design Consultant.
8. Provide a conformed set of Drawings as related to the project, depicting the condition of the intrusion detection system as installed to include but not limited to:
    a. ASI, PR and Addendum items installed throughout the duration of the project.
9. Provide a hard copy of the conformed set of drawings to be physically stored at the end of the project in a designated Intrusion detection System enclosure. Coordinate with Owner for final storage location.
10. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of the following not limited to:
    a. Intrusion detection System Riser / Signal Flow Diagrams
    b. Intrusion detection System Backboard Layouts
        1) To include intrusion detection boards, power supplies, pathways, etc.
    c. Sleeves, Backbone Cabling and Communication pathways
    d. Intrusion detection System device locations and labeling scheme.

B. Operation Maintenance Manuals
1. Unless otherwise noted, provide O M manuals electronically to Owner to include all drawings, product datasheets, hardware manuals as related to the project.
2. Coordinate with the Owner for provisioning of physical storage devices (Hardcopy, Flash Drive, CD/DVDs)

C. Manufacturer’s Product Warranty
1. Certificate of product warranty shall be provided to the Architect / Owner / Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect / Design Consultant.
2. The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.
3. One original and two copies of the Manufacturer’s product warranty shall be provided.

D. Contactor’s Statement of Warranty
1. Statement of warranty shall be provided to the Architect / Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect / Design Consultant.
2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.
3. One original and two copies of Contractor’s warranty terms and conditions to include contact information (i.e., Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION 2 16

SECTION 2 23 - VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section identifies the requirements, technical design, and specifications for the Video Surveillance system at the Fort Bend ISD George Bush High School Renovations And Additions located in Richmond, Texas (“Owner”). The video surveillance system as specified is an industry-standard that shall be an extension to the district’s current system and includes network video recorder(s)/server(s), software, licenses, cameras, mounts, and cabling as specified.

B. It is the Contractor’s responsibility to review this specification and associated project specifications and drawings in their entirety, prior to bidding on the project. By bidding on this project, the contractor acknowledges that they have read and fully understand these specifications, with no exceptions. Contractor shall review the drawings, specifications, and existing conditions prior to bidding on the project. Any discrepancies shall be brought to the attention of the architect/Design Consultant via request for information (RFI) in writing for evaluation and or clarification. If these items are not brought to the attention of the architect/Design Consultant the more costly or difficult manner, and the better quality or greater quantity of work shall be provided by the contractor in accordance with the architect's/Design Consultant's interpretation at no additional cost to the owner. Contractor shall verify the installation methodology of each device location prior to proceeding with installation. Potential obstructions or mounting conflicts due to changing conditions shall be identified via written RFI for approval with the Owner / Architect / Design Consultant.

C. Contractor shall furnish and install all materials, equipment, and labor necessary to provide a complete and functional turn-key Video Surveillance system regardless of any items not listed or described in this specification or associated drawings.

D. Requirement Sections Table of Contents

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3.8 Substantial Completion

3.9 Project Closeout Documentation

1.2 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 28 and shall be complied with in every respect. The Contractor shall examine all the items which make up the Contract Documents and shall coordinate them with the work on the project.

1.3 CONTRACTOR EXPERIENCE REQUIREMENTS

A. The Contractor shall be a certified Panasonic / Video Insight Video Management System Preferred Partner prior to submitting a bid for the work.

B. The Contractor shall possess all relevant Panasonic / Video Insight Manufacturer Certifications (i.e., video surveillance systems, hardware installation, software installation and programming) for both the company and individual technicians prior to submitting a bid for the work.

C. The Contractor shall have a Panasonic / Video Insight manufacturer certified technician onsite throughout the duration of the installation phase of the project.

D. The Contractor's Project Manager shall be dedicated to this project for the duration of the project and shall be available for all onsite coordination meetings.

E. The Contractor shall have been in business for a minimum of five (5) years.

F. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

G. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

H. Licensed in the State of Texas.

I. Submitting Contractor must be certified to install products and services for systems they are proposing. No subcontract of services will be allowed for any security scope of work. Contractor must submit to the Owner prior to starting any work the factory training certifications for all personnel that will be working on the system.

1.4 SUBMITTAL REQUIREMENTS

A. Bid / Proposal Submittal

1. Contractor shall provide as part of their bid/proposal:

a. Breakdown of proposed parts and labor required for the completion of the project. Include documentation showing annual licensing cost of ownership.

b. Proposed construction schedule in a Gant chart format

c. Contractor Safety Plan detailing safety practices around the jobsite.

d. Contractor QA / QC process detailing processes and procedures to ensure quality workmanship during installation and troubleshooting.

e. A detailed description of the installation team(s) that would perform the work.

f. A resume for each of the key project personal.

B. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect / Design Consultant / Owner.

2. The Contractor is responsible for notifying and obtaining written approval via RFI from the Architect / Design Consultant / Owner of any proprietary devices, software, and/or installation processes.

3. Contractor is responsible for obtaining permitting as required in accordance with the authority having jurisdiction (AHJ), local, city, state, federal, and/or applicable law requirements.

4. Contractor shall ensure submittals are submitted in 15 business days of award to ensure all products can be ordered and received on site in order to not cause any delays. Any products having long lead times (more than 60 days) that may negatively impact the schedule shall be clearly identified in writing so the review and approval can be expedited.

5. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e., product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

6. Contractor shall provide the following as part of their submittal:

a. Manufacturer product data sheets for each proposed system component.

1) For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified will not be approved.

2) Contractor shall identify any products that are discontinued, end of life, or near end of life, and shall propose equal alternate to the discontinued product in writing.

b. Manufacturer Product Certifications for Company.

c. Manufacturer Product Certifications for Installers.

d. Manufacturer Warranty letters.

e. Documentation indicating that Contractor has been in business for (5) years.

f. Address of Contractor's local office within a 75-mile radius of the project site.

g. Quantity of full-time, local technicians within a 75-mile radius of the project site.

h. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

i. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

j. List of subcontractors performing any work on the project. List shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

k. Manufacturer's Certification Letter confirming that the proposed video surveillance system components do not have any known cybersecurity notices, bulletins, or alerts. If a vulnerability is discovered, the contractor shall notify the Architect / Design Consultant / Owner within 24 business hours. Provide the make and model of the associated equipment and the vulnerability.

l. Manufacturer Cybersecurity Hardening Guide. If one is not available, provide documentation from the manufacturer stating such.

m. A complete set of shop drawings to include at a minimum but are not limited to:

1) Proposed and/or samples of original contractor security schedules. Schedules are not to be copy/paste of schedules provided within the contract documents. Schedules proposed shall be utilized as part of As-Built drawings with coordination with Div. 27 for additional information as required for network components.

a) Device and equipment schedules shall include at a minimum but are not limited to:

(1) Device Label

(2) Device Type

(3) Device Power Requirements

(4) Terminating MDF / IDF / Panel Location

b) Additional networking information as required to include:

(1) Rack

(2) Network switch

(3) IP addresses

(4) Patch panel

(5) Surge/lighting protection

(6) Power source

2) Elevation and Topography Drawings to illustrate the associated devices and equipment and the heights at which they will be installed.

3) Signal Flow Diagram including full security topology.

n. Supplemental documents to include at a minimum but are not limited to:

1) Contractor Safety Plan detailing steps Contractor will take to ensure a safe work environment.

2) Contractor QA/QC Document to include bench testing / initial configuration of all critical system components including but not limited to:

a) System Server(s)

b) Cameras

c) Contractor Furnished Workstations (if applicable)

3) Construction Schedule in a Gant chart format

4) Contractor Cybersecurity Hardening Guide detailing Contractor's internal policies for preventing the introduction of cyberthreats to the Owner's technology / security infrastructure.

a) Contractor Certification Letter utilizing company letterhead detailing the company policies and procedures.

b) Contractor shall provide a cybersecurity plan detailing their internal policy for preventing the introduction of cyberthreats to the Owner's technology / security infrastructure.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. All software, hardware, and equipment (from the date of RFP) shall be tested, currently available and commercially off the shelf product. (COTS).

C. All wiring, equipment, and installation materials shall be Commercial Grade, new, and of the highest quality to meet or exceed the performance and features of the equipment and devices specified herein.

D. Written approval must be obtained from the Architect / Design Consultant / Owner for any proprietary or custom software and/or equipment prior to the beginning of the project.

E. All devices shall be installed with the manufacturer recommended mounts and accessories as necessary for the installation locations type as scheduled.

F. Unless otherwise stated, all software and licensing shall be for the most current, up to date version of the system provided. For existing systems, Contractor shall obtain written verification of the Owner's most current software version and notify via RFI the Architect / Design Consultant / Owner if implementation of the most current software / license version will require an upgrade to the Owner's existing system.

G. Architect / Design Consultant / Owner will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

H. Proposed equivalent items must be approved in writing by the Architect / Design Consultant / Owner prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

I. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall submit a formal RFI for an appropriate substitute.

J. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished at no additional cost to the owner.

K. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

L. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

M. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any

concerns with lead times in writing to the Architect / Design Consultant / Owner. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the job as per the project schedule.

N. Any quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a fully functional turkey system. Where quantities are not noted, Contractor shall refer to drawings and schedules to determine exact quantities.

2.2 ACCEPTABLE MANUFACTURERS

A. Electronic Surveillance System Software
   1. Video Insight

B. Electronic Surveillance System Licensing
   1. Video Insight unlimited license per camera - (As required)
      a. IPSVC-UL (Most Current Version)

C. Electronic Surveillance System Server
   1. Network Virtual Centralized Server / Storage
      a. Owner Furnished / Owner Installed (OFOI)

D. Surveillance Cameras
   1. Interior 5 MP Dome with IR
      a. i-PRO WV-S22500-V3L
      b. Or approved equal
         1) Acceptable Mounts
            a) Wall Mount
               (1) i-PRO WV-QWL500-W
            b) Adapter Box
               (1) WV-QJB500-W
            c) Ceiling Tile Support
               (1) Caddy – 512HD (By Div. 26)
               (2) Double Gang Backbox (By Div.26)
               (3) Dual Gang Mud Ring (By Div. 26)
   2. Interior 360 Degree Fisheye 5MP Camera
      a. Panasonic WV-S4156
      b. Or approved equal
         1) Acceptable Mounts
            a) Wall Mount
               (1) i-PRO WV-QWL500-W
               (2) i-PRO PWM485W
            b) Adapter Box
               (1) WV-QJB500-W
            c) Ceiling Tile Support
               (1) Caddy – 512HD (By Div. 26)
               (2) Double Gang Backbox (By Div.26)
               (3) Dual Gang Mud Ring (By Div. 26)

3. Exterior Fixed 5 MP (Indoor/Outdoor, Day/Night) Vandal Dome
    a. i-PRO – WV-S25500-V3LN
    b. Or approved equal
        1) Acceptable Mounts
            a) Mount
                (1) i-PRO WV-QWL500-W
                (2) i-PRO PWM485W
            b) Adapter Box
                (1) WV-QJB500-W
4. Exterior Multi-sensor Camera 33MP (4K x 4) w/ IR-LED *(Camera Manufacture's label / /logo shall be installed with facing towards the center of main fields of views for best adjustment purposes. Coordinate proper mounting requirements with FBISD Security Manager).*
    a. i-PRO – WV-S8574L
    b. Or approved equal
        1) Acceptable Mounts
            a) Wall Mount
                (1) i-PRO PWM40W
            b) Pendant Cap
                (1) i-PRO WV-QSR503F1-W
            c) Pole Mount
                (1) i-PRO PAPM4W
            d) Corner Mount
                (1) i-PRO PACA4W

E. Power Equipment
    1. PoE Switch - (OFOI)
F. Surge Protection
    1. By Division 27 10 00
G. Video Surveillance System Cabling
    1. By Division 27 10 00
H. IP Cameras – Plenum rated - Orange Cable Jacket
I. Pathway Cable Support
    1. Pathway Cable Support installed by others.
J. Labeling
    1. Permanent Labels for Copper Cables
    2. Panduit Self-Laminating Labels
    3. Or approved equal.
K. Fire Stop
    1. STI Spec Seal
    2. 3M Products
    3. Or approved equal.

PART 3 - EXECUTION

3.1 CODES, STANDARDS, REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition
2. Outside Plant Design Reference Manual 5th Edition
3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling
5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998
2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
3. FCC Part 76, Cable Television Service, revised 1998

F. Insulated Cable Design Consultants Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Design Consultants, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive
3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code
5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

I. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
3. ISO/IEC 14443-3:2011 – Identification Cards
4. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

J. National Cable Television Association (NCTA)

K. National Electrical Contractors Association (NECA)
   1. NECA 1-2015 Good Workmanship in Electrical Construction
L. National Electrical Manufacturers Association (NEMA)
   1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits
M. National Fire Protection Association (NFPA)
   1. NFPA-70, National Electrical Code
   2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
   3. NFPA-101, Life Safety Code
   4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
   5. NFPA-780, Standard for the Installation of Lightning Protection Systems.
N. National Institute Standards and Technology (NIST)
O. Occupational Safety and Health Administration (OSHA)
P. Security Industry Association (SIA)
Q. Telecommunications Industry Association (TIA)
   1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.
   2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.
   3. ANSI/TIA -568.0-D.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
   4. ANSI/TIA-568.3-D-1, Optical Fiber Cabling Components Standard.
   5. ANSI/TIA–569-E Commercial Building Standard for Telecommunications Pathways and Spaces.
   6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure.
   7. ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
   8. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
R. U.S. Department of Agriculture (USDA)
   1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
   2. RUS Bull 1751F-643 (2002) Underground Plant Design
   3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
   4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
   5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)
   6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)
   7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)
   8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)
S. Underwriters Laboratories, Inc. (UL)
   1. UL 294 Standard for Video Surveillance System Units
   2. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Video Surveillance Systems and Equipment
   3. UL 109 Standard Method for Flame Tests of Flame-Resistant Fabrics and Films
   4. UL 1076 Standard for Proprietary Burglar Alarm Units and Systems

3.2 EXECUTION - GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect / Design Consultant for direction before proceeding with that part of the work.

B. Contractor shall meet the specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines. Equipment and materials installed by the Contractor shall be free of defects and damage.

D. No deviations from the plans, details or specifications shall be made without full consent in writing of the Architect / Design Consultant. The Contractor shall have written approval from the Architect / Design Consultant for any additional work beyond the Contract Documents prior to beginning such work.

E. Prior to execution, Contractor shall verify no changes in software, licensing or hardware versions have occurred since the bidding of the project. In the event of any changes, Contractor shall verify system compatibilities with their proposed design, and notify via RFI the Architect / Design Consultant / Owner if the newest version(s) will require any upgrades / additional costs to the existing system(s).

F. In the event site conditions do not allow the contractor to follow the execution requirements specified herein or in the provided details, the Contractor shall submit via RFI an alternative means and methods that is approved in writing by the Architect / Design Consultant / Owner.

G. The Contractor shall obtain written permission from the Architect / Design Consultant / Owner before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to: girders, beams, floors, walls, roofs, and/or ceilings.

H. If the Contractor does not obtain written approval from the Architect / Design Consultant / Owner prior to proceeding with the work, the contractor shall not be reimbursed for the work.

I. Contractor shall notify the Architect / Design Consultant / Owner a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect / Design Consultant / Owner to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

J. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

K. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

L. Contractor shall test all cables prior to and post installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

M. Contractor shall maintain a set of working specifications, design drawings, schedules, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect / Design Consultant / Owner.

N. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

O. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

P. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect / Design Consultant / Owner.

Q. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

R. All devices shall be installed flush, plumb, and (where required) centered on the wall, ceiling tile or structure for which it is being installed, unless otherwise noted.

S. Devices installed in public spaces shall be mounted and secured using tamper-proof security fasteners unless otherwise noted.

T. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

U. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

V. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

W. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

X. The manufacturer and contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owners technology infrastructure. These measures shall include but are not limited to:

1. The contractor shall scan contractor owned equipment for cyber threats such as viruses, malware, ransomware, etc., prior to connecting the contractor owned devices to the Owners network.

2. Ensure all technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics, i.e., servers, and other associated equipment.

3. All project documents shall be properly securely stored behind encryption and password protection to avoid unauthorized distribution of documents.

Y. All security system cabling shall be orange in color.

. All security system cabling shall be plenum rated.

1. All security system cabling shall be installed following the same pathway and support requirements as the Division 27 Communications.

3.3 COORDINATION REQUIREMENTS

A. The Contractor is responsible for the coordination of the following items and their respective disciplines included but not limited to.

B. Coordinate with the Architect to ensure that:

1. Adequate conduit is provided and that equipment backboxes are adequate for system installation.

2. Adequate communication infrastructure and power has been provided and properly located for the security system equipment.

3. Finishes and colors of all equipment visibly installed in public areas. Submit all finish and graphics for all equipment to the Architect for approval prior to installation.

4. Camera views are not obstructed by landscaping, awnings, or any other obstacles.

5. Mounting techniques are in compliance with construction techniques.

6. Camera location and field of views are adequate and meets Owner’s expectations.

C. Coordinate with the Division 26 contractor for the following:

1. Power requirements, conduit sizes/pathways, sleeves, back boxes, grounding, and bonding requirements of security devices in the following locations:

a. Interior of the building

b. Exterior of the building

c. Pole, pedestals, canopies, awnings, building architectural surface, etc.

d. Special conditions (clean room, hazardous areas, roof top mounted devices, etc.).

e. License Plate Recognition (LPR) exact camera placement requirements.

2. Coordinate location and termination of earth ground for all device specified herein as required per manufacturer installation requirements.

D. Coordinate with the Division 27 contractor for the following:

1. Installation and power requirements of network infrastructure associated to the specified system.

2. Associated patch cable lengths and quantities required for the specified system.

3. Location, power, and backup requirements for rack mount equipment.

4. Mounting and installation of injectors, midspans, extenders, surge protectors, etc.

E. The Contractor is responsible for coordinating all VMS programming requirements with the Owner / Architect / Design Consultant.

F. The Contractor shall coordinate with the Owner prior to installation for the following:

1. Network IP addressing for networked system equipment, servers, and devices.

2. Device labeling scheme

3. Firmware/software updates

4. Client workstations requirements and locations

5. Location of rack mount equipment.

6. Locations, type, programming, configuration, and Owner's final expectations for any Contractor Furnished Contractor Installed (CFCI) equipment and devices.

7. Uninterruptible Power Supply (UPS) requirements.

8. Painting of exposed, publicly visible conduit pathways

9. Camera Views (Owner's Written Acceptance Required)

3.4 SYSTEM REQUIREMENTS

A. General

1. The Video Surveillance System (VMS) shall consist of server(s), software, licensing, workstations, cameras, power source, grounding/bonding, Video Surveillance cabling, and all other peripheral components as indicated on the drawing and specified herein.

2. Any devices associated with the installation shall have the latest firmware updates downloads via Owner approved secure link from the system software and/or remotely from the manufacturer.

3. All Video Surveillance software, equipment and system requirements shall be installed per their respective Manufacturer Installation Guidelines.

4. All programming and configuration of the Video Surveillance Systems shall be accomplished by the Security Contractor.

a. The Security Contractor is responsible for all Video Surveillance System (VSS) programming to ensure the installed field devices, cameras, servers, workstations, media converters, etc., are communicating to the head-end equipment.

B. System Configuration:

1. Camera recording and display configurations shall be arranged during the provisioning phase, based on coordination with Owner and the specifications.

2. Contractor shall coordinate with Owner to determine the required pre-programmed surveillance and event-initiated configurations.

C. Graphical User Interface (GUI) Environment

1. General

a. Security Contractor shall create and provide maps for each site and building, and for each floor of the building where VSS devices are provided.

b. The VSS client shall display color graphic maps, menus and real-time information regarding system configuration, camera location and status, in graphical format, as required by Owner and described herein. Contractor shall research icon usage and use same icons through the system.

2. Map Database: Contractor shall research (with Owner), design, develop and provide site and building maps described herein in complete operating condition including graphic representations, icons, alarm and control interfaces.

a. Individual Site Plans: Individual site plan maps shall include the entire site perimeter showing buildings, vehicle and foot traffic features and street frontage. Individual site plans may contain multiple buildings. Large-scale maps shall have dynamic zoom or designated “hot spot” areas to allow the capability to zoom into an area down to 1/8” scale. Site plans shall have icons for exterior mounted devices and entry/exit portals.

b. Building Maps: Building Maps shall include the building footprint and surrounding areas, ground floor plan, a floor stacking plan (elevation) and stairwell risers. Building plans shall have icons for exterior mounted devices and entry/exit portals.

c. Floor Plan Maps: Floor plan maps shall include rooms, corridors, elevators, door and room designations (number and usage), penetrable wall points, column supports, location of access control equipment and any other details necessary to clearly and completely depict the secured environment.

d. Device Icons:

1) Individual site plans, building plans, and floor plan maps shall show text and icons for devices monitored and/or controlled by the DVMS.

2) The maps shall include active icons for video cameras allowing distinction between types, whose individual selection shall be supported via the GUI using the integration schemes described in the specifications.

D. VSS Connectivity

1. Owner Provided Network: Owner shall provide the network infrastructure for security systems, including backbone cabling, routers, network switches, and miscellaneous devices necessary to support and protect the security systems.

2. The Contractor shall coordinate with the IT department and provide IT with detailed network requirements including but not limited to

a. Location and quantity of ports needed by network appliances

b. Bandwidth and throughput requirements at key locations

c. Coordinate IP and MAC addresses required by network appliances

d. Other information as necessary to establish communications and security protection for security systems and devices

3. VSS Network: Base Servers, Network Video Recorders, and Client Workstations shall reside on Owners’ Local Area (LAN) and/or Wide Area Network (WAN) to allow global activity and shared data interchange.

4. Coordinate with the District’s IT department to determine adequate network “firewalls” to maintain the security of VSS controls and information while connected to shared computer networks and transmission media.

E. Video Surveillance System (VMS) Software

1. Server/Client/Workstation/Mobile Application Software

a. The VMS software shall be installed as the most current version; contractor shall coordinate with Owner prior to the upgrade/install to identify and evaluate any software conflicts. Conflicts shall be brought to the attention of the Architect/Design Consultant prior to installation via written Request for Information (RFI). Contractor shall coordinate the install and configure software as required to provide a full turnkey VMS.

F. Video Surveillance System Licensing

1. Contractor shall be responsible for providing and applying all necessary licensing key(s) for the specified system(s) as required by the manufacturer(s) for a fully functioning Video Surveillance System.

2. Contractor shall maintain a secured document with all license key(s) information applicable to this project. All license key(s) are property of the Owner and shall be kept secured at all times and then surrendered to the Owner at the end of the project.

G. Video Surveillance System Hardware

1. Video Surveillance Virtual Central Server

a. OFOI

1) Communications

a) Communication between servers, workstations, and networked based edge devices will communicate using the Owner provided data network unless otherwise noted. Coordinate with Owner for network configuration requirements.

2. Video Surveillance Workstations

a. OFOI

3. Surveillance Cameras

a. The Contractor shall have all on-site equipment, and personnel necessary to install, program, and troubleshoot devices during and after installation.

b. Unless otherwise stated, all cameras shall receive power through Power over Ethernet. Contractor is responsible for ensuring the power output of the network switch will meet the power requirements of the cameras to be installed. Any additional power will be the responsibility of the contractor to provide.

c. The Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines. All installed cameras, mounts, accessories, and fasteners shall be properly rated for the environmental conditions in which they will be installed. Contractor is responsible for sealing and making watertight all exterior penetrations and equipment.

d. The Contractor is responsible for all the initial configuration of camera settings, IP address settings, recording settings, presets, naming conventions, etc. unless otherwise noted.

e. Default admin account usernames and passwords shall be reconfigured prior to connecting to the Owner's network. New admin accounts and passwords shall be Owner Provided. Account passwords and settings shall be held in confidence by the Contractor and secured throughout the duration of the project to prevent unauthorized access.

f. As part of initial installation, Contractor is responsible for focusing and aiming the camera in the direction as indicated in the drawings. Unless otherwise stated, camera lenses shall provide the maximum field of view coverage to the area to provide a usable, level, clear image, pending Owner's final approval. Contractor shall plan for a minimum of one additional trip to make final adjustments of camera field of views.

4. Surge Protection / Lightning Arrestors

a. Shall be provided by Division 27 10 00

b. Protect all exterior or interior devices, control, power, signal cables and conductors that are power surges. Each surge protector shall be UL Listed.

c. Unless otherwise noted, surge protection devices shall be installed at both the edge and head end of the cabling run.

d. Surge devices shall be installed as close as accessibly possible to the equipment they are protecting.

e. Surge Protection shall be properly installed in an accessible ceiling or enclosure space to allow for cable removal during troubleshooting.

f. Include surge protection device locations on as-builts and shop drawings.

g. Provide protection against spikes, surges, noise, and other line problems for all system equipment and components.

h. Properly ground surge protection devices per the manufacturer installation requirements.

H. Video Surveillance Cabling

1. Unless otherwise noted, all data cabling from end to end to support the Video Surveillance System and all related IP devices shall be provided, installed, and maintained by Div. 27 10 00/ the Owner.

a. Alternative communications means and methods shall be provided by Division 27/28 where applicable, including but not limited to:

1) PoE over Fiber

I. Device Labeling

1. Unless otherwise, all installed devices shall be labeled. Contractor shall verify device numbering scheme and Owner's current naming convention standard in writing in advance via RFI prior to generating any labels.

2. Unless otherwise stated, all labels shall be machine printed and adhered to the device in a location that is visible and legible to the naked eye.

3. All labeling in the field shall match the same labeling scheme in the closeout documents.

4. Refer to Div. 27 specifications for data network device cabling requirements.

J. Grounding and Bonding

1. All grounding and bonding shall be performed by a licensed electrical contractor to ensure the electrical integrity of the low voltage system and devices specified herein per federal / state / local codes and standards.

2. Contractor shall notify the Architect / Owner / Design Consultant via written RFI of any site conditions or installations that will require additional coordination.

3. Contractor shall ensure proper grounding of shielded or non-shielded cabling and devices conform to the specified devices manufacturer's installation guidelines.

4. The Division 28 Contractor is responsible for coordinating with the Division 26 Contractor for grounding and bonding security devices per applicable codes and standards.

K. Conduit, Boxes and Raceways (For Reference Only - By Division 26)

1. Install all conduit necessary for a complete installation but not limited to: in finished areas, in concealed areas, in chases, in furring's, in concrete slabs and/or above suspended ceilings. No exposed conduit shall be installed within public areas.

2. Conduit shall be carefully installed, properly and adequately supported as required to comply with the requirements outlined herein and as required by the NEC to provide a neat, industry-standard installation. Horizontal conduit runs shall be supported by clamps, pipe straps, special brackets, or heavy iron tie, tied to the black iron structural members supporting the ceiling. Fastening of conduit to masonry walls, floor or partitions require malleable pipe clips with screws and suitable expansion sleeves.

3. All conduits shall be cut accurately to measurements established at the building and shall be installed without springing or forcing.

4. All required inserts shall be drilled-in and all openings required through concrete or masonry shall be saw cut or core drilled with tools specifically designed for this purpose.

5. Swab out and remove all burrs from conduit before any wires are pulled.

6. Lay out and install conduit runs as to avoid proximity to hot pipes. In no case shall a conduit be run within 75 mm of such pipes, except where crossings are unavoidable and then the conduit shall be kept at least 25 mm from the covering of the pipe crossed.

7. Provide fire stops where conduits penetrate fire rated walls and/or floors.

8. All conduit installation, whether run exposed or concealed, shall be approved prior to installation by the Architect.

3.5 TESTING REQUIREMENTS

A. The Contractor shall perform a burn-in of the system that is in accordance with the manufacturer's installation guidelines.

1. All devices shall be powered up and tested in a phased approach in a controlled testing environment on or off premise (to be coordinated with the Owner).

2. Update firmware with most up to date version (to be coordinated with the Owner).

B. Contractor shall conduct a five (5) day burn in test. Each system hardware device shall remain operational during the burn-in test for a minimum of eight (8) hours without failure.

1. Contractor shall provide successful burn-in results in writing to the Architect / Design Consultant prior to final acceptance.

C. Security Contractor shall conduct a complete QA/QC test of the entire system and provide a written report of the test results (Punchlist). The tests shall include, but not limited to:

1. Hardware

2. Software

3. Network Connectivity

4. Device Power

5. Configure system device settings

6. Setting camera views (aim focus)

7. Archiving of video footage

D. It is the responsibility of the Contractor to verify that all devices, equipment, software, interfaces, sub-system interfaces and integrations are fully functional and operational.

E. Contractor shall rectify all issues discovered during the QA/QC process and shall document these corrections via a Contractor provided punch-list.

1. At a minimum, the punch-list shall contain:

a. Date of the item identified

b. Description of the discrepancy with photographs, as necessary.

c. Date the item was rectified

F. All QA/QC items shall be corrected, and an electronic report surrendered to the Architect / Design Consultant prior to calling for Substantial Completion.

3.6 TRAINING REQUIREMENTS

A. Training outline with Owner sign off specific to the vertical market served.

B. Provide for (4) hours of training for two (2) persons on each system.

C. The Contractor shall closely coordinate with the Owner to establish a training syllabus and schedule. Submit a comprehensive training curriculum to the Owner once all preliminary coordination is complete. The Owner will revise and comment on the curriculum as required.

D. Contractor training shall be conducted onsite/virtually. Training shall be conducted by a Factory Certified trainer from the Manufacturer.

E. Operator training shall be structured to provide the appropriate users the information required for them to be able to perform the following tasks:

1. All operating procedures

2. System configuration

3. Camera Configuration

4. Rules Configuration

5. Alarm acknowledgement, alarm response logging, and map graphics functionality
6. Manipulation of cameras and presets.
7. Archiving Recorded Video

F. Administrative training shall include, but not be limited to the following:

1. All operating system procedures, configuration variables and graphic user interface (GUI)
2. Report generation

G. Record, label, and catalog all training on DVD and “user’s manual” written specifically for the Owner personnel onsite, for daily routine operations of the systems. Provide the DVD and user’s manual to the Owner for future in-house training sessions and / or reviews. Furnish all temporary equipment necessary for recording all training sessions. Maintain accurate and up-to-date time sheets of all training sessions.

H. The Owner reserves the right to use any excess training hours, not used by the time of system completion, for future training as requested until the total number of training hours has been completed.

3.7 FIELD OBSERVATIONS

A. A minimum of ten business days in advance, Contractor shall notify the Design Consultant and Owner as to the readiness for a Field Observation for the following at a minimum but not limited to:

1. Rough-In Observation – after conduits have been installed, but before walls have been installed.
2. Above Ceiling Observation – after cabling has been installed, but before ceilings have been installed.
3. Final Site Observation – a minimum of two weeks before Substantial Completion.

B. During Design Consultant’s Final Site Observation of the installed systems, provide a minimum of one factory-trained/certified technician on the operation of all installed systems for up to (1) 8-hour day to assist with Design Consultant’s functional testing.

C. Non-Conforming Work (Punch-List)

1. After receipt of written notice of deficiencies (Punch-List), Contractor shall correct all defective work within ten business days. If the work has been identified to be corrected by the Architect/Design Consultant, the Contractor shall remediate it in conformance with the contract documents at no cost to the Owner.

3.8 SUBSTANTIAL COMPLETION

A. It is the responsibility of the Contractor to ensure that all punch list items are 100% complete. The Contractor shall complete an internal Quality Assurance / Quality Control inspection, make all corrections, document the deficiencies and corrections prior to requesting for any further inspections with the Architect / Owner / Design Consultant.

B. Prior to any Substantial Completion, the Contractor shall submit a minimum two sets of preliminary (first draft) Record Drawings (As-Builts) to the Architect/Design Consultant. The preliminary Record Drawings are to be used by the Architect/Design Consultant to conduct the system substantial completion inspection.

C. The Contractor shall notify the General Contractor / Architect / Design Consultant that all the items noted above have been completed and the installation is ready for inspection.

D. The Architect / Design Consultant shall schedule an inspection of the installation with the General Contractor and the Installing Contractor(s) present.

E. The Substantial Completion Inspection shall consist of the following:

1. The Project Manager/Superintendent and Installation Technician shall be on site with all tools, materials, and equipment ready to resolve any minor issues identified.
2. The Design Consultant or designated representative shall visually inspect the installation in accordance with the official design documents.

a. The Contractor shall be prepared to remove and reinstall (minimum 10%) randomly selected security devices to inspect the mounting, cabling, terminations, connectors, labeling, tampers.

3. Punch list items shall be identified and documented in a provided punch list with a date and description of the issue found, and a date the discrepancy was addressed and the resolution.

F. Provide all personnel, equipment, and supplies necessary to perform all site testing. All video surveillance cameras shall be pointed and aimed in the views as shown in the drawings and using best practices. Contractor shall provide a minimum two employees to verify all cameras have been pointed and aimed to achieve Owner final approval. A manufacturer's representative may be present on site to answer any questions that may be beyond the technical capability of the Contractor's employees, if the Contractor so elects or by specific request of the Architect or Owner, at no charge to the Architect or Owner.

G. The Contractor shall coordinate with the Architect/Design Consultant on security related construction clean-up and patch work requirements. Security equipment closets and similar areas should be free of accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, remove all waste materials, rubbish, the Contractor's and its subcontractors' tools, construction equipment, machinery, and all surplus materials.

H. At their discretion, if the Design Consultant or their designated representative deems the site not ready for inspection/observation, the inspection will be cancelled. The Contractor(s) shall immediately address all issues identified, and shall reschedule the inspection in a timely manner so as not to affect the overall construction schedule.

I. Adjustments and Documentation: energizing and testing the systems, make adjustments and document the setting of controls, configurations, as applicable. Tabulate all data along with an inventory of test equipment, a description of testing conditions and a list of test personnel.

J. Test Documentation: Create and provide complete test reports documenting the results of the each performed on each device, control panel, power supply, and other elements of the system. Copies of preliminary test data shall accompany copies of performance testing data as part of the Operating and Maintenance submittal.

3.9 PROJECT CLOSEOUT DOCUMENTATION

A. As-Built Drawings

1. Drawings shall be provided to the Architect / Owner / Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect / Owner / Design Consultant.

2. Unless otherwise requested, Contractor shall provide digital copies of close-out documents, and deliver to the Architect / Owner / Design Consultant electronically.

3. As-Built drawings shall be produced in AutoCAD/Revit in the most current or compatible version and provided electronically in .dwg and/or .pdf format.

4. Drawings shall be provided in the original size as issued by the Architect/Design Consultant.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.

6. Provide a conformed set of Drawings as related to the project, depicting the condition of the Video Surveillance system as installed to include but not limited to:

a. ASI, PR, and Addendum items installed throughout the duration of the project.

7. Provide a hard copy of the conformed set of drawings to be physically stored at the end of the project in a designated Video Surveillance System enclosure. Coordinate with Owner for final storage location.

8. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of the following not limited to:

a. Video Surveillance System Riser / Signal Flow Diagrams

b. Video Surveillance System Backboard Layouts

1) To include Video Surveillance boards, power supplies, pathways, etc.

c. Sleeves, Backbone Cabling and Communication pathways

d. Video Surveillance System device locations and labeling scheme.

9. **A[illegible] MAC A[illegible] IP device it's [illegible] IE.** [illegible].

B. Operation Maintenance Manuals

1. Unless otherwise noted, provide O M manuals electronically to Owner to include all drawings, product datasheets, hardware manuals as related to the project.

2. Coordinate with the Owner for provisioning of physical storage devices (Hardcopy, Flash Drive, CD/DVDs)

C. Manufacturer's Product Warranty

1. Certificate of product warranty shall be provided to the Architect / Owner / Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect/Design Consultant.

2. The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.

3. One original and two copies of the Manufacturer's product warranty shall be provided.

D. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

3. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e., Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION 2 23

SECTION 28 46 00 - FIRE ALARM SYSTEM WITH ELECTRONIC AUDIO AND VISUAL DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. The contractor shall provide a complete microprocessor based 24VDC, electrically supervised, analog intelligent fire alarm system as specified herein and indicated on the drawings. The system shall include, but not be limited to, all control equipment, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. The contractor shall reuse the existing distributed microprocessor based 24VDC, electrically supervised, MULTIPLEX, integrated fire alarm system as specified herein, indicated on the drawings and required by applicable codes. The system shall include, but not be limited to, all control equipment, remote transponders, power supplies, signal initiating and signaling devices, conduit wire, fittings, and all other accessories required to provide a complete and operable system. Provide new devices, hardware and software to add new devices.

C. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

D. The system shall operate as a non-coded, continuous sounding system which will sound alarm devices until manually silenced, as herein specified.

E. The system shall be wired as a Class B supervised system for all circuits.

1.2 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces; Current Edition, Including All Revisions.

H. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

I. UL 228 - Safety Door Closers-Holders, with or without Integral Smoke Detectors; 2008.

J. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

K. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

L. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

M. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

N. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

O. UL 1638 - Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

P. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

Q. UL 2034 - Standard for Single and Multiple Station Carbon Monoxide Alarms; Current Edition, Including All Revisions.

R. UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.3 INSTALLING CONTRACTOR'S RESPONSIBILITY

A. The installing fire alarm contractor is responsible for the design of a code compliant system, which meets the intent of all State and Local Authority Having Jurisdiction Codes and their adopted amendments along all permitting of such plans and associated permit fees. Reference and coordinate with all contract specifications and plans.

1.4 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. Notifier Fire Systems NFS2 Series
   2. Siemens / Cerberus Pro Modular
   3. Edwards System Technology (EST 4)

B. Alternate Manufacturers
   1. Equipment from other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer for five (5) days prior to bid.

1.5 GENERAL REQUIREMENTS

A. Contractor Qualifications:
   1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.
   2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshal to sell, install, and service fire alarm systems as required by Article 5.43-2 of the State Insurance Code.
   3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshal's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State insurance code.
   4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.
   5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.
   6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

1.6 SUBMITTALS

A. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:
   1. Control panel configuration including wiring and interconnection schematics.
   2. Complete point to point wiring diagram showing terminal connections to all system devices.
   3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.
   4. Complete floor plan drawings in a PDF format shall locate all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.
   5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
   6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.
   7. Complete Bill of Material for reference.
   8. Programming matrix defining all input/output functions and zoning.
   9. Power supply and battery calculations.
   10. A written certification from the manufacturer stating that the fire alarm system contractor is authorized to sell, service and install the submitted equipment.

B. Submittal shall include documentation confirming all qualifications have been met. Submittals without qualification documentation shall be returned "Revise and Resubmit".

C. All submittal data shall include the contractor’s name, supplier’s name, project name, and state fire alarm license number adequately identified.

1.7 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: elevator, electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 – PRODUCTS

2.1 SYSTEM FUNCTIONAL OPERATION

A. Alarm Detection
   1. When a fire alarm condition is detected by any of the system alarm initiating devices, the following functions shall occur:
      a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledgment or silencing the alarm condition shall silence the alarm signals and cause flashing alarm LED’s to illuminate steady.
      b. A multi-character back-lit LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
      c. Any remote or local annunciator LED’s associated with the alarm zone shall be illuminated as herein specified.

d. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.

e. Activate all audible and visual alarm notification devices throughout the facility.

f. De-activate HVAC systems over 2,000 CFM.

g. Display system status changes on the remote annunciators.

h. Release all smoke doors, fire doors, fire coiling doors, fire smoke dampers and fire shutters.

i. Activate the smoke control system for the atrium.

j. Recall elevators to ground floor as specified herein, or to the alternate floor if the alarm condition originates on the ground floor

k. Unlock all electrically operated doors

B. System Trouble Detection
1. When a trouble condition is detected by the CPU, one of the system initiating, alarm or SLC circuits, the following functions shall immediately occur:

a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgment of the trouble condition shall silence the audible trouble device and cause all trouble LED's to illuminate steady.

b. The multi-character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.

c. The system common trouble indicator on associated remote annunciators shall be illuminated as specified herein.

C. Auxiliary Control
1. All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).
2. Activation of duct smoke detectors associated fans shall shutdown their respective units immediately in addition to identifying the condition as herein specified. Duct detectors shall be programmed as a supervisory condition per NFPA 72.

D. System Supervisory Detection
1. When a supervisory condition is detected by the fire alarm control panel, the following functions shall occur:

a. The fire alarm control panel supervisory indicator shall flash and the internal audible device shall sound Acknowledgment of the supervisory condition shall silence the audible device and cause the supervisory indicator to illuminate steady

b. The multi-character liquid crystal display shall display all applicable information associated with the respective supervisory condition.

c. Display the system status change on the remote annunciators

E. Remote Off-site Monitoring
1. The remote off-site monitoring system shall transmit point specific alarm, trouble and supervisory signals to an Approved Central Supervising Station (Central Station connection, phone lines or cellular connectivity service provided by Owner).

F. Fire Drill Control

1. Provide a fire drill switch located on the Fire Alarm Control Panel. When activated, this switch will activate all horns and visual devices (strobes) for a fire drill. It shall not release fire shutter, shut down air handling equipment or recall elevators. If a fire alarm condition is detected, the system shall operate as defined in part A - "Alarm Detection" of this section.

2.2 ZONING

A. The system shall have the inherent capability to employ "Intelligent" smoke detectors and addressable interface devices capable of being recognized and annunciated at the main control panel on an individual basis. All zoning/device location information shall be totally field programmable to exact job requirements as approved by the Architect/Engineer.

2.3 FIRE ALARM CONTROL PANEL

A. The fire alarm control panel shall be provided with adequate number of SLC points to serve the building plus 50% spare. The control panel shall utilize DISTRIBUTED solid state MICROPROCESSORS. The microprocessor based CPU shall be completely FIELD PROGRAMMABLE. CPU module shall provide for programmable non-volatile EEPROM memory. All circuitry shall be U.L. listed for power-limited application. System shall be sized to accommodate the capacity of the system specified and shown on the drawings. System shall be capable of being networked for future expansion.

B. Portable Buildings
   1. Provide a minimum of (50) fifty initiating points for future portable buildings. Provide (2) dedicated NAC circuits pulled to the exit point above the ceiling. Refer to floor plan for location.

C. Central Processing Unit Module (CPU)
   1. The CPU shall contain and execute all custom time control functions or control- by-event programs for specified events including 'Holiday' exceptions. Time control event/programs shall be automatically overridden by priority fire alarm events. All programs shall be held in non-volatile programmable memory, and shall not be lost if both system primary and secondary power failure occurs.
   2. System CPU shall also provide for non-alarm points for non-fire, low priority building functions. The CPU shall provide capability of multi-stage signaling, tornado warning, emergency radio communication enhancement system, positive alarm sequencing as well as remote control system operation.

D. Display Interface Assembly (DIA)
   1. The DIA shall provide a multi-character backlit, supertwist Liquid Crystal Display (LCD). It shall provide Light-Emitting Diodes (LED's) for AC POWER; SYSTEM ALARM; SYSTEM TROUBLE; SUPERVISORY; CPU FAIL; and ALARM SILENCED.
   2. The display shall provide power to a 25-key membrane keypad with control capability to command all system functions, status readouts, manual control action, and entry of any alphanumeric or numeric information. The keypad shall include means to enter multiple five digit passwords to prevent unauthorized manual control programming.

E. Control Switches
   1. Acknowledge/step Switch
   2. Signal Silence Switch
   3. System Reset Switch
   4. System Test Switch
   5. Lamp Test

F. System Outputs
   1. The system shall provide the following outputs:

a. One port for lap top and/or modem

b. One port for supervised remote LCD annunciators (RS-485)

G. Loop Interface (SLC)

1. The CPU shall communicate and provide power to all devices on its loop over a single pair of wires. The CPU shall receive digital/ANALOG information from all "intelligent" detectors and shall process this information to determine normal, alarm, trouble, and sensitivity conditions. The analog information may be used for automatic test and determination of maintenance requirements, and be U.L. listed for such use. The CPU module shall individually monitor all "intelligent" detectors for sensitivity variation initiating a trouble condition should detector sensitivity "drift" become excessive. The system control unit shall have the capability to remotely read each detector's sensitivity in % obscuration, and if need be, electronically adjust the detector sensitivity as required for existing conditions within U.L. recommended limits. In addition, the system shall incorporate a "day/night" sensitivity feature. The system shall provide capability to program each individual detector for multiple 'pre-alarm' conditions. Each 'pre-alarm' level shall be field programmable as a function of the programmed alarm level. The system shall allow designated control-by-event actions to occur as may be required prior to any sensor reaching the designated alarm point.

H. Non-Lock Walk Test

1. The system shall include a special non-lock "walk test" mode. The walk test mode shall incorporate a time-out feature to return system to normal. Test results shall be capable of being generated and displayed on the LCD annunciator.

I. Automatic Detector Test

1. The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. An automatic detector test shall occur automatically a minimum of every two hour period or be initiated manually from the FACP as desired. Automatic detector test sequencing shall be terminated upon receipt of a true alarm condition.

J. Special System Reports

1. The system shall have the ability to generate and print, upon command, system and point status reports. Selection of 'system' read status provides the operator with global system programming information as well as providing the operator with all individual point programming data. The system shall also provide the capability to print out a detailed 'history' report from system history file upon command.

K. Field Programming

1. The system shall be 100% field programmable without the need for external computers or, PROM programmers, and shall NOT require replacement of memory IC's. All programs shall be stored in non-volatile EEPROM memory. Programming shall be accomplished only after entering an appropriate and pre-selected five digit password security code. System programming mode shall NOT require the system to be taken off-line nor prohibit the system from performing its normal operations and routines. The system shall be capable of revising/changing programmed functions or system expansion at any time subsequent to initialization as described herein without factory modifications or factory programming. Field programming via the use of external computers may be considered provided programming can be accomplished on-site and the owner is permanently furnished with the required programming apparatus and software as part of this contract.

L. Event History

1. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via five digit password security code.

M. Power Supply
1. The power supply shall provide all control panel and peripheral power needs with filtered power as well as rectified 24VDC power for external audio-visual devices. All power supplies shall be designated to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits.
2. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide both positive and negative ground fault supervision, battery/charger fail condition, A.C. power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
3. Batteries shall have 24 hours of standby capacity and 5 minutes of alarm capacity. Battery charger shall recharge batteries from full discharge to full charge over a 24-hour period. Switching from normal power to battery power and back shall occur automatically.

2.4 FIELD DEVICES

A. Multi Criteria Smoke Detector (Smoke and Heat)
1. Provide intelligent multi detector. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in micro processor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen, etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes)
3. The intelligent multi criteria detection devices shall included the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chamber and comparing them to a database of actual fire and deceptive phenomena.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

B. Air Sampling Smoke Detector
1. Provide VESDA air sampling addressable smoke detector as indicated on the contract drawings ***and*** as required to provide proper coverage based on the pipe calculations. Fire alarm contractor shall include pipe layout as well as pipe calculations in the fire alarm system shop drawings.

2. The air sampling smoke detection system shall integrate into the fire alarm system as an addressable device residing on the signaling line circuit. Each VESDA detector shall be interfaced to the fire alarm system via four separate points (one trouble and three distinct alarm points). Each VESDA detector shall be provided with its own battery backup system as required by NFPA 72. VESDA smoke detector shall be located in a non-public area such as a mechanical, telephone, IDF, or storage room in the vicinity of the atrium. All VESDA air sampling shall be supported every five feet.

C. Linear Beam Detector
   1. Linear Beam Detector shall be a single unit containing the transmitter and receiver in the same enclosure. This detector can operate over a range from 17ft to 280ft (5m to 85m). The detector shall have three sensitivity settings, shall have high immunity to extraneous light, and have automatic and comprehensive test. Unit shall be monitored and interconnected to the main fire alarm control panel.

D. Intelligent Duct Detector
   1. Provide duct mounted “intelligent” photoelectric smoke detectors shall be provided per applicable codes. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type “intelligent” smoke sensors. The unit shall be capable of interchanging/accepting either photo-electronic or ionization type sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the use of zone modules.
   2. The unit shall consist of a clear molded plastic enclosure with integral conduit knockouts. The unit shall be provided with clear faceplate cover to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit’s sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination. Detectors shall be installed per NFPA 90A, and be listed with the fire alarm control panel. A remote LED shall be located on the corridor ceiling adjacent to the respective detector where detectors are not plainly visible or concealed from view.

E. Intelligent Thermal Detectors
   1. Provide analog, fixed temperature thermal detectors shall be provided where indicated on the drawings. The detectors shall use dual electronic thermostats to measure temperature levels in the chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
   2. The detectors shall provide dual alarm and power/status LED's. Status LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also provided in the base to connect an external remote alarm LED.
   3. The detectors shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

F. Conventional Weatherproof Thermal Detector
   1. Provide heat detection devices when located in harsh and/or moist environments, such as showers and similar areas, which are subject to high humidity, the following device shall be provided. Weatherproof Heat Detector 135°F Rate Compensated shall be provided. The detector shall mount in a weatherproof 4" electrical box with 1/2" NPT threaded hub. This detector shall be connected to an addressable monitor module.

G. Addressable Manual Pull Stations
   1. Manual stations shall be provided where indicated on the drawings.
      a. The manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel.

b. All manual pull stations shall be considered of durable molded polycarbonate material and shall be RED in color with raised white lettering. Stations be the dual action type.

c. All manual pull stations shall be provided with an STI-1100 series clear plastic cover with integral horn.

H. Monitor Module
1. Provide addressable monitor modules where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.

I. Control Module
1. Provide control and relay modules where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall be addressable. A status LED shall be provided which shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED shall illuminate steady when the device is actuated via the fire alarm control panel.

J. Electronic Audio Visual Devices
1. Audible/Visual alarm devices shall be electronic horn/strobe units. Devices shall be wall or ceiling mounted. Devices shall be provided with the ability to provide multiple candela settings. Units shall operate at 24VDC and be polarized supervised. Each unit shall provide a choice of three difference audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA. The visual device shall use Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit and meet the requirements of ADA and local codes. Strobe unit shall automatically flash upon operation of the horn. Horn/strobe unit shall be provided in textured white finish and be flush mounted. All visual devices shall be synchronized.

K. Electronic Alarm Horn
1. Provide solid state electronic alarm devices where indicated on the contract drawings. Units shall operate at 24 VDC and be polarized supervised. Each unit shall provide a choice of three different audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA.
2. Units shall be flush mounted and molded of high-impact white plastic.

L. Exterior Audio Visual Devices
1. All audio visual devices located outside or labeled weatherproof shall be weatherproof.
2. All devices shall be provided with a weather proof type back box.

M. High Intensity Visual Signals
1. Provide visual signal device. High intensity visual signals shall be installed where shown on the drawings and as may be required by the Americans with Disabilities Act (Public Law 101-336) and local codes. High intensity visual alarms shall be Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designated to be wall or ceiling mounted as indicated on the drawings. Signals shall operate in unison with audible alarm appliances. All visual devices shall be synchronized. Units shall be flush mounted and shall be provided in textured white.

N. Sprinkler Waterflow Switch
1. Sprinkler water flow switches shall be installed where indicated on the drawings. Each unit shall contain one set of SPDT alarm contacts. Water flow switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor.

O. Sprinkler Valve Supervisory Switch

1. Sprinkler valve supervisory switches shall be installed on each valve as indicated on the drawings. Each unit shall contain on set of SPDT contacts. Sprinkler valve supervisory switches shall be provided, installed, and adjusted by the fire protection contractor, and connected by the fire alarm contractor.

P. Auxiliary Air Handling Unit (AHU) Relays
1. Relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as (fail safe) so that if the cable is broken, disconnected etc., the AHU will automatically shutdown.

Q. Field Charging Power Supplies
1. Provide power supplies with battery backup as required. Provide 120 volts dedicated circuit to each power supply.

R. Remote LCD Alpha-Numeric Annunciators
1. Provide remote LCD alpha-numeric annunciator to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 and RS232 serial output terminal from main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The luminary source shall extinguish during normal/standby model to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:
    a. Integral time-date clock
    b. Time-date select clock
    c. Time-date/contrast adjust
    d. Display/step switch
    e. System reset
    f. System silence
    g. System acknowledge
    h. Integral trouble buzzer
2. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be semi flush mounted where shown.

S. Protective Covers
1. Provide protective covers on all wall mounted fire alarm devices located in student restrooms, corridors and in the cafeteria. These protective covers shall be manufactured by Safety Technology International, Inc. (STI). These covers shall be provided on all devices including but not limited to smoke detectors, heat detectors, audible and visual devices, pull stations, etc. The mounting of a device shall be reinforced to enable the protective covers to protect the fire alarm devices.

T. Multi Criteria Fire/Carbon Monoxide (CO) Detector (FCO-951) for sleeping rooms
1. Multi criteria acclimating detector shall be provided where shown on the drawings. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric, flame, thermal and CO technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings.
2. The detector design shall allow for a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

3. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
4. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the flame, thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base with integral sounder.
6. Provide integral low frequency sounder base for smoke detection and 4-code temporal sound for CO detection.

U. Smoke Alarms for Dwelling Units
1. The combination photoelectric smoke and carbon monoxide alarm shall be a Gentex Model GN-503/GN-503F/GN-503FF or approved equal which shall provide at least the following features and functions:
    a. The smoke alarm portion of device shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals when subjected to smoke. After 2 consecutive pulses in smoke, the alarm shall activate.
    b. The CO alarm shall utilize an electrochemical sensing element with a minimum 5-year life.
    c. The carbon monoxide alarm portion of device is adjusted not to detect CO levels below 30 PPM and will not alarm when exposed to constant levels of 30 PPM for 30 days. Per UL 2034 requirements, the device will alarm at the following levels: 70 PPM CO between 1 to 4 hours, but not less than 1 hour. 150 PPM CO between 10 to 50 minutes. 400 PPM between 4 to 15 minutes.
    d. The GN-503 Series device shall have a 9VDC alkaline battery as a back-up in the event building power is lost.
    e. The alarm shall provide an indicator when the battery is low in power, high impedance or is missing.
    f. The CO alarm will provide an audible indicator of 3 quick chirps every 30 seconds at end of life of CO sensor.
    g. The alarm shall include a solid state red color LED that will indicate presence of CO at the unit.
    h. The audible alarm shall include a solid state piezo alarm rated at 85dBA at 10ft.
    i. A visual LED monitor (condition indicator) shall slow pulse in normal operation and rapid pulse in alarm (red color)
    j. An easily accessible test button shall be provided. Push down on button for 5 seconds causing smoke/CO alarm to activate.
    k. The device shall have tandem interconnect capability of up to 12 smoke/CO alarms.
    l. The GN-503FF alarm shall have the capability to tandem interconnect with all Gentex tandem capable smoke alarms, CO alarms or combination smoke/CO alarms.
    m. The manufacturer shall provide models with the optional feature of auxiliary Form A/Form C relay contacts for initiating remote functions and annunciation and a relay option that is capable of activation by tandem interconnect wire.
    n. The combination smoke/CO alarm shall be non-latching (self-restoring).

2. Power and Interconnection Requirements
    a. Provide 120 VAC primary power from building wiring served from a commercial source.
    b. Provide interconnecting tandem wiring between smoke/CO alarms so that the activation of one alarm will activate all of the alarms in the individual unit.

PART 3 - EXECUTION

3.1 DESIGN CRITERIA

A. The contractor shall provide drawings for Owner, Engineer and Fire Marshal's approval.
B. Drawings shall be prepared by a state licensed alarm planning superintendent.
C. Drawings shall comply with all local, state and federal code. These include but are not limited to NEC, UL, NFPA, etc.
D. Locate the fire alarm control panel in main telecommunications / MDF room unless otherwise directed by the owner.
E. Locate a remote annunciator in the main lobby area unless otherwise directed by the owner.
F. Provide additional items required above minimum codes include the following:
    1. Manual pull stations shall be located not more than 5 feet from the entrance to each exit. Additional manual stations shall be located so that the travel distance to the nearest manual station does not exceed 200 feet. Provide Stopper II covers on all manual pull stations
    2. Manual pull station heights shall be a minimum of 42" and a maximum of 48" measured vertically, from the finished floor level to the activating handle or lever.
    3. Smoke Detectors – Paths of egress, electrical rooms, mechanical rooms, MDF, IDF, elevator lobby, storage rooms, top of stairs, elevator machine room, top of elevator shaft, above each fire alarm panel and remote power supplies terminal cabinets. Smoke detectors shall also be provided in each room/area that can be occupied by kindergarten and pre-kindergarten children, which shall include cafeteria, gymnasiums, daycares, libraries, classrooms and similar areas.
    4. Duct type smoke detectors – all air handling units over 2,000 CFM in duct work or return air paths.
    5. Heat Detectors – Shops, kitchens, coffee bars, central plants, boiler room, garages, truck bays and other non conditioned areas when detection is required..
    6. Flow switches – Sprinkler riser.
    7. Horns - throughout the building.
    8. Strobes – throughout the building.
    9. Remote Power supplies: Locate in mechanical rooms, electrical rooms, MDF or other areas approved by Owner.
    10. Smoke Detectors with low frequency sounder bases inside and outside all sleeping rooms. Do not locate over bed.
    11. Monitor Fire Pump.
    12. System Carbon Monoxide Detectors - Provide one in each sleeping room, kitchen, and the first room of each mechanical system where gas furnaces are serving spaces. Combination CO and smoke detector may be utilized in sleeping rooms. Provide CO detection in locations where gas water heaters are provided. Locate near the door; do not locate over the bed.
    13. Tamper Switches- Sprinkler riser and vaults located on the site.

3.2 INSTALLATION

A. Wiring

1. All wiring shall be in accordance with NFPA 72 and NFPA 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be plenum rated, U.L. Listed, limited energy (300 volt) FPLP or MPP wire and shall be run open in return air ceiling plenums. The wire shall comply with NFPA 262 for such applications, shall be of the low smoke producing fluorocarbon type and shall comply with NEC Article 760 if so approved by the local authority having jurisdiction. Provide conduit in all inaccessible locations, inside concealed wall, all mechanical/electrical rooms, or other areas where wiring might be exposed and subject to damage.
3. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.
4. All wiring for SLC signaling circuits shall be of the twisted low capacitance type to guard against outside RF and EMF interference and induced noise.
5. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog-legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA.
6. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Devices shall be appropriately marked designating it as the terminating device on the respective circuit.
7. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.
8. All insulation on conductors shall be RED with traces to identify circuits.

B. Open Wiring
1. Systems utilizing open wiring techniques with low smoke plenum cable.
2. Support wire clear of knock out panels access panels and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot on centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.
3. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.
4. Provide a junction box to make up all joints and splices.
5. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

C. Conduit/Raceway
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified in division 26 specifications and per National Electrical Code.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

5. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Minimum Wire Sizes Shall Be As Follows:
   1. Signaling Line Circuit: 18 AWG
   2. Notification Appliance Circuit: 14 AWG
   3. Relay Control Circuits: 18 AWG

E. 120 VAC Power wiring
   1. Contractor shall provide all required dedicated 20 amp, 120 VAC power circuits for the fire alarm system including but not limited to the main fire alarm panel, remote amplifier panels, and remote strobe light power supplies. Connect to emergency power when available in the building.

F. Sprinkler Valves
   1. Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit. Connect all water flow switches to the alarm circuit. Coordinate exact locations of water vaults valves and flow switches with sprinkler contractor.

3.3 NOTIFICATION APPLIANCE CIRCUITS SYNCHRONIZATION

A. All visual and audible devices shall be synchronized per the current state adopted version of NFPA 72. Provide all components required.

3.4 SMOKE AND COMBINATION FIRE SMOKE DAMPERS

A. Provide duct type smoke detectors in ductwork downstream of each smoke damper and fire smoke damper. Locate within 5 feet on the damper. Provide a remote smoke detector reset device. Provide access panel when not located above an accessible ceiling. Interlock with HVAC unit serving the ductwork to shut down.

3.5 MISCELLANEOUS SYSTEMS

A. Monitor all fire suppression systems, carbon monoxide system panels and refrigerant system control panels.

3.6 TEST AND REPORTS

A. A state licensed factory trained technical representative of the manufacturer shall perform the final control panel connections and supervise testing of the system and it shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

B. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. All testing shall be supervised by a licensed fire alarm superintendent.

C. The installing contractor shall provide a complete written report on the functional test of the entire system. The test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

D. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.

3.7 SPARE PARTS AND ATTIC STOCK

A. Provide 5% spare field devices including labor to install them. Devices not used shall be given to the Owner at completion of the job.

B. The fire alarm contractor shall include in his bid the cost to provide and install the additional spare parts and attic stock and associated cabling as indicated on the schedule on the contract drawings. All devices on this schedule not used during construction shall be turned over to the owner at the time of job completion.

3.8 WARRANTY

A. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

3.9 GRAPHIC FLOOR PLANS

A. Provide 1/16” = 1’-0” floor plan showing all devices and zoning. Zoning shall correspond to the zone on the fire alarm control panel. The floor plans shall be framed with a glass cover and located by the fire alarm control panel. This graphic floor plan shall use the actual room numbers based on the architectural graphics package. Verify specific requirements with Owner. Provide a sample for approval.

END OF SECTION

SECTION 31 00 00 – SITE EARTHWORK

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Operations required for the excavation and placement of materials on site.
   1. Operations required for the excavation of borrow material from approved sources.
   2. Compaction of natural subgrades.
   3. Placement and compaction of embankments to grade.
   4. Finish grading.
   5. Disposal of excess or unsuitable materials.
   6. Other required operations.
   7. Earthwork must conform with dimensions and typical sections shown, and within lines and grades established on the Drawings.

B. The Contractor shall inform and satisfy himself as to character, quantity and distribution of material to be excavated.

C. Work in this Section covers all site work not under proposed building slabs, mechanical equipment, or other specialized areas requiring a structural slab. Civil site work begins 5’ outside the limits of proposed building slabs.

1.2 EXISTING UTILITIES

A. The plans show the approximate location of all known underground utility lines and structures. Where pipes, ducts and other structures are encountered in the excavation but are not shown on the plans, immediately notify the Owner's Representative.

1.3 CLASSIFICATIONS

A. Top Soil: Top 6 inches of natural surface soil possessing the characteristics of representative soils on the site that produce growths of grass or other vegetation. Topsoil includes grasses and other vegetation.

B. Subgrade: Consists of that portion of the surface on which a compacted embankment or pavement is constructed.

C. Compacted Embankment: Earth fill placed and compacted between subgrade and underside of pavement and fill areas adjacent to paving.

D. Borrow: Material taken from approved sources to make up any deficit of excavated material. The borrow shall have a measured plasticity index of between 7 and 20, and shall be free of organic matter and excess silt.

E. Finish Grading: Operations required for smoothing disturbed areas that are not overlaid with pavement.

F. Stripping of Ground Surface: All vegetation, all decayed vegetable matter, rubbish and other unsuitable material within the areas to be graded not removed by clearing shall be stripped or otherwise removed to ground level before grading or other earthwork is started. In no case will such material be allowed to remain in or on the areas to be graded.

G. Excavation: After all necessary stripping has been done, excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings.

H. Compaction: Compaction of soil materials shall be measured as a percentage of Standard Proctor density as determined by the AASHTO Standard T 99 procedure.

PART 2 P R O D U C T S

2.1 EQUIPMENT

A. Furnish, operate and maintain such equipment as is necessary to produce uniform layers, section and smoothness of grade for compaction and drainage.

B. Tamping Rollers:
1. Use tamping rollers with one or more cylindrical drums. Each cylinder must be at least 48 inches long and 40 inches in diameter.
2. The minimum weight per linear foot of drum length must be 1500 pounds weighted and 1000 pounds empty.
3. For tamping rollers with multiple cylinders, each cylinder must rotate independently and the cylinders must be pivoted on the main frame so that the units can adapt to irregularities in the ground surface.
4. Provide approximately 2.7 tamping feet per square foot of drum surface on each cylinder. Stagger the feet uniformly over the cylinder surface. Each foot should have a face area between 5 and 7 square inches and a clear projection from the cylinder surface of 7 to 9 inches. Equip each unit with a device for cleaning the feet as the cylinders rotate.
5. Use a crawler tractor with sufficient power to pull the tamping roller at a speed of approximately 3.0 miles per hour.

C. Rubber Tire Rollers:
1. Use rubber tire rollers having two axles and not less than a total of nine wheels with pneumatic tires.
2. Mount the wheels so that the rear tires will not follow in the tracks of the forward tires and so the unit will give uniform compaction over the entire width of coverage.
3. Mount the axles in a rigid frame with a loading platform or body suitable for being ballasted to a specified gross weight between 10 and 50 tons loading. The Owner's Representative will specify the tire inflation and gross weight.
4. If the roller is not self propelled, the towing equipment must also have pneumatic tires.

D. Use tank trucks, pressure distributors or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

E. Scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment and other equipment must be suitable for construction of fills.

2.2 EARTH FILL

A. Obtain embankment fill from required excavation or, if excavated material is not sufficient, from Borrow areas approved by the Owner's Representative.

B. Use the best material available from excavation or borrow. Suitability of fill material is subject to the approval of the Owner's Representative.

C. Fill material must be free of excessive silts. Do not use soil containing brush, roots, sod or similar perishable material.

D. Embankment material must have a plasticity index between 7 and 20 inclusive.

PART 3 E X E C U T I O N

3.1 REMOVAL OF TOPSOIL

A. Remove topsoil within the limits of the construction areas as shown on the Drawings.

B. Stockpile acceptable existing topsoil for future distribution. Protect stockpiled topsoil from other excavated materials. Contractor shall have existing topsoil tested for compliance with Division 32. Non-conforming topsoil shall be removed and disposed of off-site.

3.2 EXCAVATION

A. As shown on the Drawings, excavate to lines, grades and elevations required for subsequent construction of embankments or pavement. Remove materials within the indicated limits and dispose of as directed.

B. Maintain grades during excavation for complete drainage. When required, install temporary drains or drainage ditches to intercept or divert surface water and prevent interference or delay of the Work.

C. If at time of excavation it is not possible to place material in the proper section of permanent construction, stockpile the material in approved areas for later use.

D. Stones or rock fragments larger than 2 inches in their greatest dimension will not be permitted in top 6 inches of subgrade.

E. Uniformly dress cut and fill slopes to grade, cross section and alignment, as shown.

3.3 SUBGRADE UNDER PAVEMENTS

A. After excavation is made to subgrade lines under proposed pavements, remove and replace soft or undesirable material with select material as specified for embankments. Stabilize and compact the subgrade as stated in the sections on stabilization of pavement subgrade.

3.4 TREATMENT OF NATURAL SUBGRADE UNDER EMBANKMENTS

A. After excavation is made to lines under proposed embankments, remove soft or undesirable material to a depth determined by the Owner's Representative. Break down sides or holes or depressions to flatten the slopes.

B. Fill each depression with the appropriate soil for the materials to be placed on the subgrade. Place the fill in layers moistened and compacted as specified in this section.

C. After depressions have been filled and immediately before placement of compacted fill in a section of the embankment, thoroughly loosen the foundation material to a depth of 6 inches. Remove roots and debris turned up while loosening the soil.

D. Compact the surface of the embankment subgrade as specified in the following paragraphs.

E. Take care to prepare the embankment so that planes of seepage or weakness are not induced. Should the Owner's Representative suspect such a deficiency, the material must be thoroughly broken and recompacted before proceeding with construction.

3.5 PLACING EMBANKMENT FILL

A. Do not place fill on any part of the embankment subgrade until the subgrade preparation has been inspected by the Owner's Representative.

B. During the dumping and spreading process, remove all roots, stones and debris that are uncovered in the embankment material.

C. After dumping, spread the material in horizontal layers over the entire fill area. The thickness of each layer before compaction must not exceed 8 inches unless otherwise directed. As soon as possible after placement begins, crown the surface to drain freely and maintain such conditions throughout construction.

D. If the compacted surface of a layer is too smooth to bond with succeeding layers, loosen the surface by harrowing or other approved method before continuing the work.

E. Stabilize and compact the top of embankment fills under pavement sections as specified in the section on stabilization of pavement subgrade, construction plans, and Geotechnical Report.

3.6 MOISTURE CONTROL

A. Developing the maximum density obtainable with the natural moisture of the embankment material is preferred. However, the moisture content must be 1 to 3 percentage points wet of optimum, as determined by AASHTO Test Method T 99.

B. If the moisture content is too high, adjust to within the specified limits by spreading the material and permitting it to dry. Assist the drying process by discing or harrowing if necessary. When the material is too dry, sprinkle each layer with water. Work the moisture into the soil by harrowing or other approved method.

3.7 COMPACTION

A. Compact each layer of embankment with suitable rollers as necessary to secure at least 95% of the standard Proctor density, within the specified range of the moisture content, according to AASHTO Test Method T 99.

3.8 DISTRIBUTION OF TOPSOIL

A. Preparation:
   1. Prior to placing topsoil, scarify the subgrade to a depth of 2 inches to provide effective bonding of the topsoil with the subgrade. Use a chisel plow with the chisels set 10 inches apart.
   2. Shape all areas designated for grading, including cut and fill areas, to receive a minimum of 4 inches of topsoil.
   3. In areas that require only blading and dressing, the adequacy of existing topsoil will be determined by the Owner's Representative.

B. Placement:
   1. Do not haul or place wet topsoil. Also prohibited is placement of topsoil on a subgrade that is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or proposed planting.
   2. Distribute topsoil uniformly and spread evenly to an average thickness of 4 inches. Do no compact topsoil. Correct irregularities in the surface to prevent formation of depressions where water could stand.
   3. Perform the spreading operation so that planting can proceed with little additional tillage or soil preparation. Leave the area smooth and suitable for lawn planting.

C. Where any portion of the surface becomes eroded or otherwise damaged, repair the affected area to establish the condition and grade prior to topsoil placement. Replace topsoil.

3.9 MATERIAL DISPOSAL

A. Remove excess excavated material and excess topsoil from the area before substantial completion. Stockpile materials separately in designated areas. Excess soil, topsoil and strippings shall become property of the Contractor and shall be removed from the site.

B. Dispose of waste material without causing expense or damage to the Owner.

END OF SECTION

SECTION 31 06 20.15 - CEMENT STABILIZED SAND

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cement stabilized sand.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

N. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.3, Materials Qualifications.

1.5 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Division 2 and the following requirements:
1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.
2. Deleterious materials:
   a. Clay lumps, ASTM C 142 - less than 0.5 percent.
   b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
   c. Organic impurities, ASTM C 40, color no darker than standard color.
3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.2 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.3 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:
1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.
2. Complete molding of samples within 4 hours after addition of water.
3. Perform strength tests (average of two specimens) at 48 hours and 7 days.
4. Perform cement content tests on each sample.
5. Perform moisture content tests on each sample.
6. Plot average 48-hour strength vs. cement content.
7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:
1. Gradation
2. Plasticity index
3. Organic impurities
4. Clay lumps and friable particles
5. Lightweight pieces
6. Moisture content
7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:
1. f'c% 1/2 standard deviation

PART 3 E X E C U T I O N

3.1 PLACING

A. Place sand-cement mixture in maximum 8-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +/- 3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

C. Where water lines cross wastewater lines, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code 290.44(e)(4)(B):
   1. Provide minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume. Use at least 2.5 bags of cement per cubic yard of mixture (2 sacks per ton of dry sand).
   2. Unless otherwise shown on the Drawings, embed wastewater main a minimum of six inches above and below.

3.2 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:
   1. Supplier and plant number
   2. Time material was batched
   3. Time material was sampled
   4. Test age (exact hours)
   5. Average 48-hour strength
   6. Average 7-day strength
   7. Specification section number
   8. Indication of compliance / non-compliance
   9. Mixture identification 3
   10. Truck and ticket numbers

11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.3 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:
   1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
   2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength tests (average of two specimens) have 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Owner's Representative, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.3.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.4 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:
   1. Credit per Cubic Yard = $30.00 x 2 (100 psi - Actual psi) 100

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to Owner.

END OF SECTION

SECTION 31 06 20.17 - UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:
1. Concrete sand
2. Gem sand
3. Pea gravel
4. Crushed stone
5. Crushed concrete
6. Bank run sand
7. Select backfill
8. Random backfill

C. Material Handling and Quality Control Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Unsuitable Material:
1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:
1. Materials meeting specification requirements.
2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.

H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Division 33 for other definitions regarding utility installation by trench construction.

1.4 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregate.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.

E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Standard Test Method for Amount of Material in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

L. TxDOT Tex-460-A - Material Finer Than 75 Fm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.3, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.6 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.3B.

B. Verification tests of backfill materials may be performed by Owner in accordance with Division 1.

C. Random fill obtained from the project excavation as a source is exempt from prequalification requirements by the Contractor but must be inspected and tested by the Geotechnical Testing Lab prior to use to insure material meets specifications.

PART 2 P R O D U C T S

2.1 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.1B, or by product descriptions, as given in Paragraph 2.2.

B. Class Designations Based on Laboratory Testing:
1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
   a. Plasticity index: non-plastic.
   b. Gradation: D_{60}/D_{10} - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
   a. Plasticity index: non-plastic to 4.
   b. Gradations:
      1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
      2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
      3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
   a. Plasticity index: greater than 7.
   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
4. Class IVA: Lean clays (CL):
   a. Plasticity Indexes:
      1) Plasticity index: greater than 7, and above A line.
      2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
   b. Liquid limit: less than 50.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
5. Class IVB: Fat clays (CH):
   a. Plasticity index: above A line.
   b. Liquid limit: 50 or greater.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.2 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Owner's Representative. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Division 31.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:
1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Owner's Representative, provided that physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2"	100
3/8"	85 to 100

No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:
1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Owner's Representative.
2. Non-plastic fines.
3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment By Ranges of Nominal Pipes Sizes		
	>15"	15" – 8"	< 8"
1"	95 – 100	100	--
¾"	60 – 90	90 – 100	100
½"	25 – 60	--	90 – 100
3/8"	--	20 – 55	40 – 70
No. 4	0 – 5	0 – 10	0 – 15
No. 8	--	0 – 5	0 – 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Division 31 to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Division 31.

K. Cement Stabilized Sand: Conform to requirements of Division 31.

L. Concrete Backfill: Conform to Class B concrete as specified in Division 32.

2.3 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.

2. Plasticity of material passing No. 40 sieve.
3. Los Angeles abrasion wear of material retained on No. 4 sieve.
4. Clay lumps.
5. Lightweight pieces.
6. Organic impurities.

B. Production Testing. Provide reports to Owner's Representative from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.

C. Assist Owner's Representative in obtaining material samples for verification testing at source or at production plant.

PART 3 E X E C U T I O N

3.1 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied. If on-site excavated materials are not acceptable for use as backfill, the Contractor shall provide from another source at no additional cost to the owner.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Owner's Representative may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Owner's Representative, expense for sampling and testing required to change to different material will be at the cost of the Contractor.

D. Bank run sand, select backfill and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.

E. Owner does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.2 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Owner's Representative in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.3 FIELD QUALITY CONTROL

A. Quality Control

1. The Owner’s Representative may sample and test backfill at:
   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
   b. On-site stockpiles.
   c. Materials placed in Work.
2. The Owner’s Representative may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: Owner's testing laboratory will provide verification testing on backfill materials, as directed by Owner’s Representative. Samples may be taken at source or at production plant, as applicable.

END OF SECTION

SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.2 PROTECTION

A. Protect following from damage or displacement:
1. Plants, trees and landscape features designated to remain.
2. Utilities designated to remain.
3. Bench marks, monuments, and existing structures designated to remain.

3.3 CLEARING

A. Remove stumps, main root ball, and root system to:
1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
2. Depth of 24 inches below finished surface of required cross section for other areas.
3. Backfill and compact excavations with suitable backfill material as described in Division 31.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

D. Where clearing and grubbing has been performed in advance by others, Contractor shall perform such additional clearing and grubbing in the manner describe herein as required for the construction of the facilities as described in this Contract at no additional cost to the Owner.

3.4 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Division 1.

B. Remove on site fences as shown on plans including buried concrete bases as required. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

SECTION 31 22 00 – SITE GRADING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures, building pads, and play fields.

C. Replacement of topsoil and finish grading for planting.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

B. For sites located in the 100-year Floodplain, the Contractor shall provide an As-Built Survey of all work (cut or fill) located within the 100-year Floodplain. Survey shall be signed and sealed by a Registered Land Surveyor and be on the same survey datum as the design drawings.

1.4 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

C. Protect survey bench marks and control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Topsoil - Soil Type: Topsoil excavated on-site.
   1. Graded.
      a. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
      b. Provide imported topsoil conforming to the requirements of Division 32 as required.
      c. On-site topsoil may be used. Contractor shall have on-site topsoil test and analyzed for compliance with Division 32. It is the Contractor’s responsibility to add approved imported topsoil as required to achieve grades and specified depth at no additional cost to the Owner.
   2. Other Fill Materials: Reference relevant sections of Division 32 and the Drawings.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, leveler contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage. Damage to existing drainage structures will be corrected by Contractor at no additional cost to the Owner.

D. Notify utility company to remove and relocate utilities.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Division 31 Specifications for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site, pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove/Break-up soil clumps greater than 1” in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

E. Place topsoil in areas where seeding is indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil to the following compacted thicknesses:
   1. Areas to be seeded with Grass: 4 inches (150 mm).
   2. Areas to be sodded: 4 inches (100 mm).

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Lightly compact placed topsoil.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

C. When grading drainage areas to drainage structures (inlets), the area must have a uniform slope to drainage structure. Steep drop-offs into drainage structures will not be allowed.

3.7 FIELD QUALITY CONTROL

A. See Division 1 and Division 31 for compaction density testing.

B. Contractor shall coordinate site inspection with Owner/Architect/Engineer prior to placement of final topsoil and landscape materials.

3.8 CLEANING AND PROTECTION

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water. Excess topsoil and subsoil to be removed at no additional cost to Owner.

B. Leave site clean and raked, and ready to receive landscaping.

END OF SECTION

SECTION 31 23 16.14 - TRENCH SAFETY SYSTEM

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Trench Safety System for the construction of trench excavations.

B. Trench Safety System for structural excavations that fall under provisions of State and Federal trench safety laws.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

B. The Trench Safety System requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.

C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit a safety program specifically for the construction of trench excavation. Design the Trench Safety Program to be in accordance with OSHA 29 CFR standards governing the presence and activities of individuals working in and around trench excavations.

C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by Contractor.

D. Review of the safety program by the Engineer will only be in regard to compliance with this specification and will not constitute approval by the Engineer nor relieve Contractor of obligations under State and Federal trench safety laws. The Engineer/Owner will not provide approvals or disapprovals of submittal but will retain for records.

1.5 REGULATORY REQUIREMENTS

A. Install and maintain Trench Safety Systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. The Contractor is responsible for obtaining a copy of OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209.

C. Legislation that has been enacted by the Texas Legislature with regard to trench safety systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., § 756.021 (Vernon 1991).

1.6 INDEMNIFICATION

A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install and maintain Trench Safety Systems in accordance with provisions of OSHA 29 CFR.

B. Install specially designed Trench Safety Systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.

C. A competent person, as identified in the Contractor's trench safety program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.2 INSPECTION

A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the Trench Safety Systems to ensure that the installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.3 FIELD QUALITY CONTROL

A. Contractor shall verify specific applicability of the selected or specially designed Trench Safety Systems to each field condition encountered on the project.

END OF SECTION

SECTION 31 23 33 – EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:
   1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
   2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
   3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
   4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Division 1.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.
   1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
   2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
      a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
      b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
      c. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Division 31.

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

1.4 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.5 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.6 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit backfill material sources and product quality information in accordance with requirements of Division 31.

C. Submit trench excavation safety program in accordance with requirements of Division 31. Include designs for special shoring as required.

D. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

1.7 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by Owner in accordance with requirements of Division 1 and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Division 31.

1.8 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 P R O D U C T S

2.1 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.8, Special Shoring Design Requirements.

2.2 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Division 31.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Division 31.

C. Geotextile (Filter Fabric): Conform to requirements of Division 1.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.1 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Owner’s Representative.

3.2 PREPARATION

A. Establish traffic control to conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Division 31.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Owner's Representative and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Division 2, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Division 1. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Division 1.

3.3 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.
   1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.
   2. Notify Owner's Representative in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Owner's Representative is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Owner's Representative with 48 hours notice prior to field excavation or related work.

3.4 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Division 1.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the Owner.

3.5 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Minimum trench width shall be wide enough to allow for hand tamping of backfill material under haunch of pipe.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
12” and Less	O.D. + 18”
15” to 30”	O.D. + 24”
36” to 42”	O.D. + 36”
Greater than 42”	O.D. + 48”

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Owner’s Representative and obtain instructions before proceeding.

F. Shoring of Trench Walls.
1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Owner’s Representative. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:
1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by Pipeline Company’s representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 3 feet of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Owner’s Representative. Provide supports for collar or welds. Discuss with Pipeline Company’s representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.6 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Division 31. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Division 31.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Division 1. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.7 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, if directed by Owner's Representative, in accordance with Paragraph 3.7B above. Removal of unstable or unsuitable material may be required if approved by Owner's Representative:
   1. Even though Contractor has not determined material to be unsuitable, or
   2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Division 1.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.8 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means. Backfill material shall be hand tamped under haunch of pipe to insure backfill material totally encases pipe.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water line construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Division 31. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:
   1. Class I, II and III Embedment Materials:
      a. Maximum 6 inches compacted lift thickness.
      b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
      c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Owner's

Representative.

2. Cement Stabilized Sand (where required for special installations):
   a. Maximum 6 inches compacted thickness.
   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
3. Class I Embedment Materials.
   a. Maximum 6-inches compacted lift thickness.
   b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
   c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
4. Class II Embedment and Cement Stabilized Sand.
   a. Maximum 6-inches compacted thickness.
   b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
   c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

K. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.9 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction and inspections.

B. For water lines, backfill in trench zone, including auger pits, intermediate and site pits, with bank run sand, select fill, or random backfill material as specified in Division 31.

C. For sewer pipes, use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand to level 12 inches below the pavement. For sewer pipes under natural ground backfill from 12 inches above top of pipe to 6” inches below finish grade with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement. Use topsoil for 6-inch backfill directly under natural grade. For backfill materials reference Division 31.

D. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.

E. When shown on Drawings, random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

F. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.
   1. Class I, II, III or IV or combination thereof (Random Backfill):
      a. Maximum 8-inches compacted lift thickness.
      b. Compact by vibratory equipment to minimum of 95 percent of maximum dry

density determined according to ASTM D 698.
c. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by Owner's Representative.

2. Cement-Stabilized Sand:
a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Select Backfill:
a. Place in maximum 8-inch loose layers.
b. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
c. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Owner's Representative.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.
1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at no additional cost to Owner, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.
2. Maximum 8-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, INLETS, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate structure with cement stabilized sand; minimum of 12 inches below base, minimum 12 inches around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement.

C. In unpaved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 1 foot around walls, up to within 12 inches of finish grade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use suitable on-site material and topsoil for the 12-inch backfill directly under natural ground.

3.11 FIELD QUALITY CONTROL.

A. Test for material source qualifications as defined in Division 1.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics,

in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Owner's Representative.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
   1. For open cut construction projects and auger pits: Unless otherwise approved by Owner's Representative, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
   2. A minimum of three density tests for each full shift of Work.
   3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
   4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
   5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
   6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
   7. Recompacted placement will be retested at same frequency as first test series, including verification tests.
   8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Division 1.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Soil treatment for termite control.

1.2 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. IPM: Integrated Pest Management. It is the policy of the Owner to use Integrated Pest Management (IPM) as the strategy for control of termites in and around Owner's facilities.

C. PCO: Pest control operator.

D. TDA SPCS: Texas Department of Agriculture – Structural Pest Control Service

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Treatments and application instructions, including EPA-Registered Label.
2. Material Safety Data Sheets (MSDS).
3. Classification of Termiticide: Indicate as green listed, yellow listed, or red listed product as recognized by the TDA SPCS.
4. Concurrent with submission of product data to Architect, provide one copy of the submittal to the Owner.
5. Proposed termiticides must be approved by the Owner prior to the start of any preparation or application.

C. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

C. Conform with all applicable codes and ordinances including the Federal Insecticide, Fungicide, and Rodenticide Act (7 United Sates Code 136 et seq.); Owner policies and procedures; Environmental Protection Agency regulations in 40 Code of Federal Regulations; Occupational Safety and Health Administration regulations; and state and local regulations.

D. Conform with approved termiticide list criteria established by the TDA SPCS

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Criteria established in the most recent TDA SPCS definitions of these products.
1. Green List. All products must be from the following: inorganic termiticides (i.e., boric acid, disodium octoborate tetrahydrate, silica gels, diatomaceous earth); insect growth regulators; insect baits in tamper-resistant containers or for crack and crevice placement only; microbe-based insecticides; botanical insecticides (not including synthetic pyrethroids) containing not more than 5% synergists; biological (living) control agents.
2. Yellow List. All EPA Category III and IV termiticides (i.e., products carrying a CAUTION signal word) not included in the Green List, with the exception of restricted-use or state limited-use termiticides as defined under the Federal Insecticide, Fungicide, and Rodenticide Act and/or the Texas Agricultural Code.
3. Red List. All Category I and II termiticides (i.e., products carrying a WARNING or DANGER signal word), not included in the Green List, or restricted-use termiticides, or state limited-use termiticides as defined under the Federal Insecticide, Fungicide, and Rodenticide Act and/or the Texas Agricultural Code.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Manufacturers:
   1. AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.
   2. Bayer Corp.; Garden & Professional Care, www.bayerprocentral.com.
   3. DowElanco, www.dowagro.com.
   4. FMC Corp.; Pest Control Specialties, www.ag.fmc.com.
   5. Zeneca Professional Products, www.zeneca.com.
   6. Substitutions: Section 01 60 00 - Product Requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings.

   1. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

   1. Applications shall be completed no less than seven days prior to initial occupancy of the structure, or as otherwise indicated on the termiticide label, whichever is longer.

   2. Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment uniformly and evenly to the specified areas.

B. Required Areas of Application:

   1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.

5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

3.4 PROTECTION AND CORRECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions and manufacturer’s recommendations and requirements.

C. Post warning signs in areas of application as required for Commercial Treatment.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Machine drilled shaft and belled base.

B. Concrete materials and mix.

C. Reinforcement.

D. Shaft liner.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing: Requirements for concrete reinforcement.

B. Section 03 30 00 - Cast-in-Place Concrete: Requirements for concrete.

1.3 REFERENCE STANDARDS

A. ACI SPEC-336.1 - Specification for the Construction of Drilled Piers; 2001.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A252/A252M - Standard Specification for Welded and Seamless Steel Pipe Piles; 2019.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer's qualification statement.

C. Project Record Documents: Record actual locations of piers, pier diameter, and pier length. Accurately record the following:

1. Sizes, lengths, and locations of piers.

2. Sequence of placement.

3. Final base and top elevations.

4. Deviation from indicated locations.

5. Placement and configuration of reinforcement deviations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Casing: Temporary casings of steel, in accordance with ASTM A283/A283M, Grade C; ASTM A36/A36M; or ASTM A929/A929M; of sufficient strength to withstand handling and drilling stresses, concrete pressures, and surrounding earth and water pressures.

1. The contractor shall assume for Base Bid that a minimum of 35% of the piers on the project will require steel casing above the bell of the pier to prevent water seepage.

B. Shaft Liner: In accordance with ASTM A252/A252M, Grade 1; single length steel pipe, with plain ends, of diameter and wall thickness indicated.

C. Concrete Materials and Mix: Specified in Section 03 30 00; using Type II cement, maximum 3/4 inch aggregate size, 3,000 psi 28 day strength, 3 inch slump.

D. Equipment: Appropriate for dewatering excavated shaft.

PART 3 EXECUTION

3.1 PREPARATION

A. Use placement method which will not cause damage to nearby structures.

B. Notify adjacent and affected land owners and building occupants with 90 days notice before proceeding with the work.

C. Prepare to place piers from existing site elevations.

D. Grade perimeter of pier and shaft area to prevent surface water from draining into soil borings. Provide temporary means and methods, as required, to maintain surface diversion until no longer needed, or as directed by the Architect.

3.2 INSTALLATION

A. Construct piers in accordance with ACI SPEC-336.1.

B. Drill vertical pier shafts and belled bases to diameters and depths indicated.

C. Place steel casings immediately after drilling. Set firmly in place. If casing is to be temporary, install shaft liner with sufficient strength to withstand concrete pressures.

1. Withdrawal of temporary casings is at option of Contractor.

D. Clean shaft and bottom of loose material. Provide temporary means and methods, as required, to remove all water from soil borings as needed, or until directed by the Geotechnical Engineer.

E. Allow inspection of shaft and liner prior to placement of reinforcement and concrete.

F. Place reinforcing steel in accordance with Section 03 20 00.

G. Place concrete in single pour, in accordance with Section 03 30 00 with equipment designed for vertical placement of concrete.

H. Coordinate casing withdrawal with concrete placement so that concrete pressure head exceeds anticipated outside soil and water pressure above bottom of casing at all times during withdrawal.

I. Extend reinforcement for connection of caps, grade beams as indicated on drawings.

J. Set tops of piers to elevations indicated.

3.3 TOLERANCES

A. Install piers with maximum variation from location, plumbness, bottom area, diameter, and anchorage locations as specified in ACI SPEC-336.1.

B. Maximum Variation From Vertical: 1 in 48.

C. Maximum Variation From Design Top Elevation: Plus 3 inches, minus 1 inch.

D. Maximum Out-of-Position: 2 inches.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.

B. Test Piers: Same diameter and type as specified for other piers, placed in same manner.

C. Accepted test piers may not be used in work.

3.5 UNACCEPTABLE PIERS

A. Unacceptable Piers: Piers that fail, are placed out of position, are below elevations, or are damaged.

B. Provide additional piers or replace piers failing to comply with specified requirements.

END OF SECTION 31 63 29

SECTION 32 11 13.13 – LIME-TREATED SUBGRADES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Foundation course of lime stabilized natural subgrade material.

1.2 UNIT PRICES

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. ASTM D698 - Tests for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 5.5 lb Rammer and 12 inch Drop.

B. ASTM D1140 - Method of Test for Amount of Material in Soils Finer than the No. 200 Sieve.

C. ASTM D1556 - Density of Soil in Place by the Sand-Cone Method.

D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D3017 - Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-600-J - Lime Testing Procedure.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit certificates stating that hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

D. Submit manufacturer's description and characteristics for rotary speed mixer and compaction equipment for approval.

1.5 TESTS

A. Testing will be performed under provisions of Section - Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D4318.

C. Sampling and testing of lime slurry shall be in accordance with Tex-600-J.

D. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.

E. Soil will be evaluated to establish percent of hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

F. Moisture-density relationship will be established on material sample from roadway, after stabilization with lime, in accordance with ASTM D698.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

C. Quicklime can be dangerous; exercise extreme caution if used for the Work. Contractor shall become informed about recommended precautions in the handling, storage and use of quicklime.

PART 2 P R O D U C T S

2.1 WATER

A. Water shall be clean; clear; and free from oil, acids, alkali, or vegetable matter.

2.2 LIME

A. Type A - Hydrated lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide and magnesium hydroxide.

B. Type B - Commercial lime slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
1. Grade DS: Pebble quicklime of a gradation suitable for use in the preparation of a slurry for wet placing.
2. Grade S: Finely-graded quicklime for use in the preparation of a slurry for wet placing. Do not use grade S quicklime for dry placing.

D. Lime shall conform to requirements of Item 260 of the 1993 Texas Department of Transportation Standard Specifications.

E. Lime slurry may be delivered to the job site as commercial lime, or may be prepared at the job site by using hydrated lime or quicklime. The slurry shall be free of liquids other than water and shall be of a consistency that can be handled and uniformly applied without difficulty.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.2 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
1. Cutters accurately provide a smooth surface over entire width of cut to plane of secondary grade.
2. Visible indication that cut is to proper depth.

C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting. Obtain uniform stability.

3.3 LIME SLURRY APPLICATION

A. Mix hydrated lime or quicklime with water to form a slurry of the solids content specified. Commercial lime slurry shall have dry solids content as specified. Conform to cautionary requirements of Paragraph 1.6C concerning use of quicklime.

B. Apply slurry with a distributer truck equipped with an agitator to keep lime and water in a consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on the same working day.

C. Apply so that dry subgrade will contain a minimum lime content by weight of dry subgrade as instructed by Testing Laboratory and detailed in Geotechnical Report.

3.4 PRELIMINARY MIXING

A. Do not mix and place material when temperature is below 40 degrees F and falling. Base may be placed when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain a homogeneous friable mixture free of clods and lumps.

C. Shape mixed subgrade to final lines and grades.

D. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.5C can be met during preliminary mixing:
   1. Seal subgrade as a precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
   2. Cure soil-lime material for 1 to 4 days. Keep subgrade moist during cure.

E. Stabilized subgrade shall extend a minimum of two feet beyond edge of pavement or back or curb as applicable.

3.5 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to a minimum of optimum or above.

C. Mix and pulverize until all material passes a 1-3/4-inch sieve; a minimum of 85 percent, excluding nonslacking fractions, passes a 3/4-inch sieve; and a minimum of 60 percent excluding nonslacking fractions passes a No. 4 sieve.

D. Shape mixed subgrade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.6 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content as determined by Testing Laboratory. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

B. Start compaction immediately after final mixing, unless approved by Engineer.

C. Spread and compact in two or more approximately equal layers where total compacted thickness is to be greater than 8 inches.

D. Compact with approved heavy pneumatic or vibrating rollers, or a combination of tamping rollers and light pneumatic rollers. Begin compaction at the bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized base to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

F. Compact to following minimum densities at a moisture content of optimum to 3 percent above optimum as determined by ASTM D698, unless otherwise indicated on the Drawings:
1. Areas to receive pavement without subsequent base course: Minimum density of 95 percent of maximum dry density.
2. Areas to receive subsequent base course: Minimum density of 95 percent of maximum dry density.

G. Seal with approved light pneumatic tired rollers: Prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

3.7 CURING

A. Moist cure for a minimum of 3 days before placing base or surface course, or opening to traffic. Time may be adjusted as approved by Engineer. Subgrade may be opened to traffic after 2 days if adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base, surface, or seal course within 14 days after final mixing and compaction unless prior approval is obtained from the Engineer.

3.8 TOLERANCES

A. Completed surface shall be smooth and conform to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.9 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section - Testing Laboratory Services.

B. A minimum of one phenolphthalein test will be made at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Contractor may, at his own expense, request additional cores in the vicinity of cores indicating nonconforming in-place depths. If the average of the tests falls below the required depth, place and compact additional material at no cost to the Owner.

D. Compaction Testing will be performed in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017 at a random locations near depth determination tests. Rework and recompact areas that do not conform to compaction requirements at no cost to the Owner.

E. Fill test sections with new compacted lime stabilized subgrade.

3.10 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect the asphalt membrane, if used, from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION

SECTION 32 11 29.13 – LIME-FLY ASH-TREATED BASE COURSES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Foundation course of lime/fly ash stabilized subgrade material.
   1. Application of lime slurry and fly ash to subgrade.
   2. Mixing, compaction, and curing of lime, slurry, fly ash, water and subgrade into a stabilized foundation.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Moist Cure: Curing soil lime/fly ash material to obtain optimum hydration.

B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.4 REFERENCES

A. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certification that fly ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Conform to requirements of Division 2.

B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.

B. Conform to requirements of City of Houston Standard Specifications Section 02336 – Lime Stabilized Subgrade for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry.

C. Fly ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C 618, Type ‘C” or “F” and following:
   1. Minimum CaO content of 20 percent
   2. Loss on ignition not to exceed 3 percent
   3. Contain no lignite ash

D. Asphaltic Seal Cure: Conform to requirements of Division 32.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to City of Houston Standard Specifications Section 02336 – Lime Stabilized Subgrade with following exceptions:
   1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.
   2. Apply lime/fly ash as single mix, single pass over lower PI soils.
   3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing last stabilizing agent.

B. Stabilized subgrade shall extend two feet beyond edge of pavement or back of curb as applicable.

3.2 QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. Soil will be sampled to establish percent of fly ash and hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

C. Testing will be in accordance with Division 1.

END OF SECTION

SECTION 32 13 13.00 - CONCRETE PAVING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185 - Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

D. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

E. ASTM C 33 - Standard Specifications for Concrete Aggregates.

F. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

G. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

H. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

I. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).

J. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

K. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

L. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

M. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

N. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

O. ASTM C 150 - Standard Specification for Portland Cement.

P. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.

Q. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

S. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

U. TxDOT Tex-203-F - Sand Equivalent Test.

V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual compressive strength obtained from design mixes at required test ages.

C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.

D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Owner’s Representative.

1.5 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without written permission of Owner’s Representative.

B. Class of aggregate being used may be changed before or during Work with written permission of Owner’s Representative. Comply new class with specifications.

C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Reject aggregates mixed with dirt, weeds, or foreign matter.

E. Do not dump or store aggregate in roadbed.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Portland Cement:
1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
2. Bulk cement which meets referenced standards may be used when method of handling is approved by Owner’s Representative. When using bulk cement, provide satisfactory weighing devices.
3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Owner’s Representative.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).
1. Maximum percentage by weight of deleterious substances shall not exceed following values:

Item	Percentage by Weight of Total Sample Maximum
Clay lumps and friable particles	3.0
Material finer than 75-µm (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1¾” sieve	0
Retained on 1½” sieve	0 to 5
Retained on ¾” sieve	30 to 65
Retained on 3/8” sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test	
*Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8” sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

E. Mineral Filler: Type “C” or Type “F” fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture as approved by the Engineer. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementatious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.

F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Owner's Representative.

H. Reinforcing Steel:
1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.
3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

2.2 EQUIPMENT

A. Conform Equipment to requirements of ASTM C 94.

2.3 MIXING

A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Mix design to produce concrete which will have minimum compressive strength of 3,000 psi at 7 days and 3,500 psi at 28 days. Slump of concrete shall be at least 2 inches but no more than 5 inches, when tested in accordance with ASTM C 143.
1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.
4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:
1. Concrete Mix: Compressive strength greater than or equal to 3,500 psi at 72 hours.
2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.
3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5 inches, when tested in accordance with ASTM C 143.

4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Division 32.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted base is ready to support imposed loads and meets compaction requirements.

B. Verify lines and grades are correct.

3.2 PREPARATION

A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.

B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.3 EQUIPMENT

A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.

B. Subgrade Planer and Template:
1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8 inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.
2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8 inch. Fit template with accurately adjustable rods projecting downward at 1 foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.

D. Hand Finishing:
1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.
2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3 foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.

F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.
   1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.
   2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.
   3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.4 FORMS

A. Side Forms: Use forms of approved shape and section. Form depth shall be equal to required edge thickness of pavement. Forms with depths greater or than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1 inch. Length of form sections shall be not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used.

B. Form Setting:
   1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by Owner’s Representative.
   2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3.5 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.

B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.

C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.

D. Secure in required position to prevent displacement during placing and finishing of concrete.

E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

3.6 FIBROUS REINFORCING

A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.7 PLACEMENT

A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.

B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

C. Concrete slump during placement shall be 2 to 5 inches, except when using traveling-form paver, slump shall be maximum of 2 inches.

D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10 feet long.

E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.8 COMPACTION

A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.9 FINISHING

A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.
   1. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike

template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make minimum of two trips over each area. Screed pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

D. Concrete finish shall be complete in a uniform, workman like manner. Excessive roughness from burlap or broom finishing may be cause for removal and replacement from Owner.

E. Contractor shall immediately clean any concrete spillage from existing pavements. If concrete spillage is allowed to dry on existing pavements, it shall be the Contractor's responsibility to remove the excess concrete and repair the existing concrete to like-new condition. Owner may reject repairs and require removal and replacement of the area.

3.10 JOINTS AND JOINT SEALING

A. Conform to requirements of Division 32.

3.11 CONCRETE CURING

A. Conform to requirements of Division 32.

3.12 TOLERANCES

A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10 foot straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16 inch per foot from nearest point of contact. Maximum ordinate with 10 foot straightedge shall not exceed 1/8 inch. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

A. Perform testing under provisions of Division 1.

B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Owner's Representative for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens at 7 days and 3500 pounds per square inch at 28 days.

C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than

that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. Minimum of one 4 inch core will be taken at random locations per 375 feet per 12 feet lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3,500 pounds per square inch.

E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in-place depths at no cost to Owner. In-place depth at these locations shall be average depth of four cores.

F. Fill cores and density test sections with new concrete paving or non-shrink grout.

3.14 NONCONFORMING PAVEMENT

A. Remove and replace areas of pavement found deficient in thickness, or that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. When measurement of any core is less than specified thickness, actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to Owner.

3.15 UNIT PRICE ADJUSTMENT

A. The Owner may chose to adjustment payment for nonconforming concrete.

3.16 PAVEMENT MARKINGS

A. Restore pavement markings to match those existing in accordance with the applicable governmental standard specifications and details and Owner’s Representative's requirements.

3.17 PROTECTION

A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength concrete is used meeting specified 72 hour strength.

B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Owner’s Representative.

C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for Work.

D. Maintain concrete paving in good condition until completion of Work.

E. Repair defects by replacing concrete to full depth.

END OF SECTION

SECTION 32 13 13.10 - CONCRETE PAVEMENT CURING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 156 - Standard Test Method for Water Retention by Concrete Curing Materials.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 P R O D U C T S

2.1 COVER MATERIALS FOR CURING

A. Conform curing materials to one of the following:
1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.2 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m2 in 72 hours using test method ASTM C 156.

PART 3 E X E C U T I O N

3.1 CURING REQUIREMENT

A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.2 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or replacing.

3.3 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.4 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.

B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.5 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.

C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Owner’s Representative, but not less than one gallon per 200 square feet of surface area.

3.6 TESTING MEMBRANE

A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.

B. Re-Apply membrane compound immediately at no cost to Owner when membrane fails above test.

END OF SECTION

SECTION 32 13 13.25 - CONCRETE SIDEWALKS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statues.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certified testing results and certificates of compliance.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements of Division 32. Use No. 3 reinforcing bars.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Division 31.

E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2 inch by 4 inch lumber as forms will not be allowed.

F. Sand Bed: Conform to material requirements for bank run sand of Division 31.

G. Sodding: Conform to material requirements for sodding of Division 31.

H. Coloring for wheelchair ramps: use integrally colored concrete (no surfacing painting allowed). Verify color with Owner/Architect (typically Red Brick).

PART 3 E X E C U T I O N

3.1 REPLACEMENT

A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.

B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.2 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Conduct clearing and grubbing operations in accordance with Division 31.

D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Division 31. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

E. Immediately after subgrade is prepared, begin form work and concrete placement.

3.3 PLACEMENT

A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.

B. Reinforcement:
   1. Install reinforcing bars.
   2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.
   3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.
   4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.
   5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

C. Expansion Joints: Install expansion joints with load transfer units in accordance with Division 32.

D. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

E. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

F. Wheelchair ramps located in the Public ROW shall have a contrasting color. Color shall be part of the concrete mix (i.e. no painting or coatings). Wheelchair ramps located on-site are not required to be a contrasting color.

G. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

H. Finish edges with tool having 1/4 inch radius.

I. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Division 1. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Division 32.

3.4 CURING

A. Conform to requirements of Division 32.

3.5 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 2500 psi at 7 days and 3000 psi at 28 days.

C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. If the Contractor places concrete without notifying the laboratory, the Owner will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.

E. Sampling of fresh concrete shall be in accordance with ASTM C 172.

F. Take slump tests when cylinders are made and when concrete slump appears excessive.

G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.

H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.

I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Owner’s Representative. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.6 NONCONFORMING CONCRETE

A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. Replace nonconforming sections at no additional cost to Owner.

3.7 PROTECTION

A. Maintain newly place concrete in good condition until completion of Work.

B. Replace damaged areas.

END OF SECTION

SECTION 32 13 73 - CONCRETE PAVING JOINTS AND SEALANTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

E. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 P R O D U C T S

2.1 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:
   1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
   2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.2 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.3 JOINT SEALING COMPOUND

A. Provide joint sealant as indicated on the drawings.

2.4 LOAD TRANSMISSION DEVICES

A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.

B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.5 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Owner's Representative.

PART 3 E X E C U T I O N

3.1 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling, or cracks.

3.2 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

A. Place 3/4 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 60 feet apart or as shown on the drawings. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.4 CONSTRUCTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

B. Required only if noted on plans.

3.5 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

B. Required only if noted on plans.

3.6 SAWED JOINTS

A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4 inch wide. Maintain depth of one

quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 12 hours of concrete placement. Saw joints at required spacing (15' maximum between sawed joints) consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

C. Reference plans for requirements on sealing sawed joints.

3.7 JOINTS FOR CURB, CURB AND GUTTER

A. Place 3/4 inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120-foot centers.

B. Expansion joints in curbs shall be sealed to match expansion joints in pavement.

3.8 JOINTS FOR CONCRETE SIDEWALKS

A. Provide 3/4 inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 40 feet.

B. Sidewalk expansion joints shall be sealed to match expansion joints in pavement.

3.9 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

B. Driveway expansion joints shall be sealed to match expansion joints in pavement.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

B. Use joint sealing equipment in like new working condition throughout joint sealing operation, and be approved by Owner's Representative. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of Work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

SECTION 32 16 13 – CURBS AND GUTTERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit details of proposed form work for approval.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Division 32.

C. Grout: Nonmetallic, non-shrink grout containing no chloride producing agents conforming to the following requirements.
   1. Compressive strength
      a. at 7 days: 3500 psi
      b. at 28 days: 4000 psi
   2. Initial set time: 45 minutes
   3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Division 32.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Owner’s Representative.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.2 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Division 32. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4 inch deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.3 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4 inch edger. Finish edges with tool having 1/4 inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.4 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Owner’s Representative. Use of mechanical methods shall provide specified curb design and finish.

3.5 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Division 32.

3.6 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.7 PROTECTION

A. Maintain curbs and gutters in good condition until completion of Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. This Section specifies the requirements for providing pavement markings of the following types.

1.2 UNIT PRICES

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 QUALITY ASSURANCE

A. All markings shall comply with the requirements of the SDHPT Standard Specifications for Construction of Highways, Streets and Bridges, the SDHPT Manual on Uniform Traffic Control Devices for Streets and Highways and the applicable regulations and standards of Harris County, Texas and the City.

B. Reference Standards Applicable to this Section:
   1. FS: Federal Specifications and Standards:
      a. TT-P-1952E: Paint, Traffic and Airfield Marking, Waterbourne
   2. SDHPT: Texas State Department of Highways and Public Transportation:
      a. Standard Specifications for Construction of Highways, Streets and Bridges.
      b. Texas Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD).
      c. The above referenced SDHPT standards may be obtained from:

         State Department of Highways & Public Transportation Highway Building
         11th and Brazos Streets
         Austin, Texas 78701
         Tel: (512) 475-2081

1.4 SUBMITTALS

A. Certificates:
   1. Certificates shall be submitted for each product indicating that the product complies with the requirements of this specification.

B. Manufacturer's Data:
   1. Manufacturer's installation instructions, specifications and recommendations shall be submitted for each pavement marking product.

1.5 JOB CONDITIONS

A. Markings shall be installed only on clean and dry surfaces. Paint markings shall be applied only when surfaces have the following minimum temperatures:
   1. A minimum of 50 degrees F for asphalt and a minimum of 60 degrees F for concrete.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Paint:
   1. Marking paint shall be traffic white, yellow, or as designated on the drawings, and shall comply with the requirements of FS TT-P-1952E.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Markings shall be installed and surfaces prepared in accordance with the requirements of the applicable item in the SDHPT Standard Specifications and the TMUTCD.

B. Markings shall be protected from vehicular traffic until not subject to damage by such traffic. Contractor shall be responsible for repair and replacement of markings until written acceptance by the Owner.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual swing gates and related hardware.
5. Factory colored vinyl finish for fabric, framing, and all components.

B. Related Sections:
1. Section 03 33 00 – Cast-in-Place Concrete: Concrete requirements for fencing footings.

1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
4. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
5. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
6. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

1.3 SYSTEM DESCRIPTION

A. Fence Height: as indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding 10 feet.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Samples: Submit two samples of vinyl coated fence fabric illustrating colored finish.

D. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.

E. Manufacturer's Installation Instructions: Submit installation requirements.

1.5 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

C. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

1.8 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 7 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric: CLFMI Standard Industrial.
1. Wire Size: Minimum 9-ga.
2. Mesh Size: 2 inch typical.
3. Selvage: Knuckled at both selvages.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.2 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

2.3 GATES

A. General:
1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
2. Factory assemble gates.
3. Conform to requirements specified for PVC coated steel chain link fence except that PVC coated aluminum alloy framing conforming to ASTM B429 may be used.
4. Design gates for operation by one person.

B. Swing Gates:
1. Fabricate gates to permit 180 degree swing.
2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.
3. Hardware: Fork latch with gravity drop, center gate stop and drop rod, minimum two 180 degree gate hinges for each leaf, and hardware for Owner-furnished padlock.

2.4 FINISHES

A. Galvanized Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Vinyl-Coated Components and Fabric: Vinyl coating, black color in accordance with ASTM F934 over galvanized coating.

C. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

D. Accessories: Same finish as fabric.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 1 inch above finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: ASTM F567.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Install top rail through line post tops and splice with 6 inch long rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Place fabric on outside of posts and rails.

I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

J. Position bottom of fabric 2 inches above finished grade.

K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

M. Install bottom tension wire stretched taut between terminal posts.

N. Support gates from gate posts. Do not attach hinged side of gate from building wall.

O. Install matching color coated support arms barbed wire continuously along top of fence. Slope supports inward or outward as required to match existing fencing. Attach 3-strands of galvanized barbed wire, tension and secure. Install gates with fabric and barbed wire overhang to match fence.

P. Install gate with fabric to match fence. Install three hinges on each swinging gate leaf, latch, catches, drop bolt, retainer and locking clamp.

Q. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

R. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

S. Excavate holes for posts without disturbing underlying materials.

T. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

U. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

3.2 ADJUSTING AND CLEANING

A. Clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

B. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

END OF SECTION

SECTION 32 90 00 LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and General Provisions of the Contract, including General and Supplementary Conditions and all applicable specification sections apply to this section.

1.02 SCOPE OF WORK

A. Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, prepared soil mix, supply and planting of trees, shrubs, groundcovers, grass and fertilizing, installation maintenance, clean-up, plant guarantee and replacement and other work related thereto.
B. Protection of existing features. During construction, protect all existing trees and specified vegetation, site features and improvements, structures and utilities as specified on drawings and/or in specifications.
C. Tree stake removal at the 11 month review

1.03 REFERENCE STANDARDS

A. American Joint Committee on Horticultural Nomenclature Standardized Plant Names
B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
C. American Standard for Nursery Stock
D. ANSI A300 and Z60.1

1.04 QUALITY ASSURANCE

A. Installation of planting shall be performed by a single company specializing in landscape work. Contractor shall be licensed by the Texas Association of Nurserymen and shall possess an agricultural certificate and licensed pest applicator. Contractor shall have not less than 5 years of experience in this type and scale of work.
B. Contractor to attend a pre-installation meeting with District Representatives, Landscape Architect and others and participate in ongoing meetings during installation with General Contractor and others.

1.05 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architect for any other requirements.

1.06 SUBMITTALS

Provide the following:

A. Product data and source for all items listed in Materials.
B. Material samples for planting mix, mulch and fertilizer. Samples shall be packaged in plastic bags and shall be typical of the material to be delivered to the site.
C. Color photos of plant material with gallon size indicated, height pole/scale rod (as needed) and plant name with grower and/or nursery source name provided.
D. List the Landscape Contractor responsible for the work on this project.
E. Landscape Architect reserves the right to request purchase and delivery tickets when needed to verify correct variety or material for the project and to reject plant material on site.

1.07 UTILITY VERIFICATION

A. The contractor is responsible for contacting local utility companies for underground line location and verification. If underground lines interfere with planting then Landscape Architect shall be notified to make revisions prior to planting at no additional cost to the owner.

B. The contractor shall be responsible for all damages resulting from failure to comply with this requirement.

PART 2 - MATERIALS

2.01 MATERIAL delivery may begin upon approval of samples or as directed.

A. Topsoil: Contractor responsible for adding topsoil from off-site source if needed. Limited existing topsoil will be available. Existing and off-site borrow soil shall be natural, friable, fertile soil possessing characteristics of the local area. Topsoil is defined as the total amount of soil stripped in the top 4" inches less the vegetative layer. Soil to be free of subsoil, stones, clay, clod, sticks and roots. Topsoil containing nut grass or dallis grass will be rejected. See TOPSOIL specifications for requirements.

B. Mixed soil: If pre-mixed soil is used, an acceptable product is 'Landscaper Mix' by Nature's Way Resources or approved equal.

C. Compost: Compost as manufactured by Nature's Way Resources, Inc. or approved equal. Major nutrients: Nitrogen, Phosphorus, Potassium. Secondary: Calcium, Magnesium, Sulfur. Micronutrients: Iron, Manganese, Zinc, Copper. Materials to be commercially prepared fully composted under sustained temperatures to 165 degrees with a PH averaging 6.5 to 7.0.

D. Commercial Fertilizer: MicroLife 6-2-4 All organic, biological fertilizer as available at San Jacinto Environmental Supplies. No substitutions.

E. Mulch: Landscape finish mulch shall be imported, dark brown in color, shredded hardwood bark used for top dressing and shall have a particle size that passes 100% through a one inch think square mesh and is retained on a 1/8" square mesh.

F. Sand: shall be sharp white sand (not bank sand).

G. Staking material:
1. Landscape fiber strap. ArborTie webbing green in color or equivalent.
2. Stakes shall be sound No. 2 Douglas fir, lodge poles 2-1/2" in diameter, and not less than 7 ft. long, pointed at one end with the slope of the point back about 6" from the end. Stakes shall be cut off square at top after installation to a level of 2" above the straps.
3. Three stakes per tree (45 gallon and larger).
4. Two stakes per tree (30 gallon and smaller).

H. Post-emergent herbicide: Mirimichi Weed & Grass Killer available at San Jacinto Environmental Supplies in Houston, Texas

I. Pre-emergent herbicide: Barricade granular pre-emergent herbicide or approved equal applied to planting beds.

2.02 PLANTS

A. Quality: plants shall be No. 1 grade and true to species, commercial nursery grown in accordance with good horticultural practices under similar climatic conditions similar to those of the project site (approximately 200 miles or less from project site). They shall be fresh, vigorous, of normal growth, free of disease, insects, insect eggs and larva, and have strong root systems. Plant material shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List. **No root bound plant material shall be accepted.**

B. Size: all plants shall equal or exceed the measurements stated in the plant list. Plants shall be measured when branches are in their normal positions. If larger plants are used, then the root ball shall be increased in proportion to the size of the plant.
   1. Caliper measurements shall be taken 6 inches above the natural ground line for trees up to and including 4 inches in caliper and measured 12 inches above the natural ground for trees over 4 inches in caliper.

C. Selection: plants shall be subject to inspection and approval by the Owner at their place of growth and upon delivery for conformation to specification requirements. Such approval shall not impair the right of inspection and rejection during progress of the work.
   1. Trees with multiple leaders, unless specified, will be rejected. Trees with damaged bark, abrasions, crooked leaders, sunscald, disfiguring knots, pruned limbs over ¾" in diameter that are not completely healed will be rejected.

D. Contractor Responsibility: all questions regarding plant material selection, size and specifications will be directed to the Owner's Representative prior to submission of bids. Submission of bids will be understood that the Contractor fully understands the plans and specifications; that all plants and materials will be available in size, character and number at the time of installation. No substitutions will be allowed after bids are received.
   1. The plant list on the drawing is for the contractor's information only and is not guaranteed that quantities therein are correct. The contractor shall be responsible for providing the correct quantities and installation at the correct spacing.

2.03 PLANTING PREPARATION

A. Rock, underground construction work, tree roots, utility conflicts or obstructions encountered in the excavation of tree or shrub pits shall be brought to the attention of the Landscape Architect. Proceed with work after alternate locations have been designated by the Landscape Architect.

B. Layout plants and trees in locations shown on drawings. Use color coded wire and wood stakes. Stake location of each tree and major shrub and outline of shrub and groundcover beds for approval by Landscape Architect.

C. Apply Mirimichi for existing weed elimination only in lawn and planting areas prior to bed prep or planting.

D. All planting beds to be constructed with final grade and mulch below building weep holes. Under no circumstances shall the building weeps be covered. Contractor to bring all related concerns to the Landscape Architect prior to installation.

PART 3 - EXECUTION

3.01 WORK PROCEDURE

A. Planting Mix for all root zones: all tree and shrub areas shall be backfilled with a prepared planting mix as follows: 25% parent soil, 25% topsoil, 25% compost, 25% sand (not bank sand).

B. Excavation for container trees shall be twice the width of the container (with angled sides), with natural ground shelf and the depth shall keep the root flare and ball 1”-2” above grade (see detail).
   1. After tree pit excavation, fill hole 2/3 full with water. Water must be absorbed before tree planting. If water is not absorbed within 24 hrs of flooding, let Landscape Architect know. A tree de-watering sump detail will be provided for tree pits holding water.
   2. Ground shelf lift must be in place before tree planting.

C. Excavation for shrub pits shall be the width of the container + 18" and the depth shall keep the root ball 1”-2” above grade (see detail). Lay weed barrier cloth prior to mulch.

D. Excavation for groundcover beds shall include replacement of existing soil (for the entire groundcover bed) with prepared planting mix to a depth of the container (see detail). Spread granular pre-emergent across total planting bed at rates recommended by manufacturer. Apply January 1 – March 20 to target summer weeds and August 15 – September 15 to target winter weeds. All groundcover/ornamental grass beds to have weed barrier installed as well.

E. When plant pits have been backfilled approximately 2/3 full, water thoroughly before installing remaining soil to top of pit, eliminating all air pockets.

F. Water all plants immediately after planting.

G. Mulch all planting areas 2”-3" deep immediately after planting.

H. Do not mound mulch against tree trunk.

I. Staking of all trees by Contractor in accordance with plan details. Plants shall stand plumb after staking and all trees shall be staked within 24 hours of planting. Stakes shall be driven into the ground (not root ball) until rigid.

3.02 FINE GRADING

Landscape Contractor will receive the project in a rough grade condition. It is the Landscape Contractor’s responsibility to fine grade the ‘green’ areas; that includes adding topsoil as required to smooth out the rough grade and remove the clumps, clods, dips, ruts, bumps, lumps and removal of construction debris within the ‘green’ areas. Contractor to fine grade and provide positive drainage and even transition to drain inlets.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and

washing if necessary.

3.04 INSTALLATION MAINTENANCE

A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of all punch list items.
B. Installation maintenance shall begin immediately after each plant is planted and continue until all punch list items are completed. This includes all watering operations (temporary irrigation and hand watering for 90 days).
C. Installation maintenance shall also include watering, weeding, mowing and edging once a week, weeding, mulching, removal of dead materials, resetting plants to proper grades or upright positions, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the planting and new work free of ants, insects and disease.

3.05 PROTECTION

Planting areas and plants shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner. If any plants become damaged, injured or stolen, they shall be treated or replaced as directed by the Owners Representative at no additional cost to the Owner. The Owner does not assume any responsibility for security until project acceptance.

3.06 INSPECTION AND ACCEPTANCE

A. Substantial Completion notice will be issued only after Owner and Landscape Architect inspect and approve all required planted work including grass areas.
B. All plant material to be alive, healthy and thriving and grass areas established.
C. Acceptance notice will be issued only after Owner and Landscape Architect inspect and approve all planting work as in accordance with Contract Documents but exclusive of replacement of plant materials under the Warranty Period.

3.07 OWNER RESPONSIBILITY

Owner shall take responsibility of the landscape areas by maintaining, monitoring and repairing as needed the irrigation system to ensure the irrigation system remains in working order. Owner shall also fertilize, mow and maintain the landscape in a healthy condition with best practices and industry standards for landscape maintenance.

3.08 WARRANTY PERIOD AND REPLACEMENTS

A. Apart from Natural Act of God occurrences, Contractor shall warrant unconditionally that all trees, shrubs, groundcovers planted under this contract will be healthy and in flourishing condition of active growth for two years from date of Substantial Completion.
B. Any delay in completion of planting operations which extends the planting into more than one planting season will extend the Warranty Period correspondingly.
C. Replace without cost to the Owner, and as soon as weather conditions permit, all dead plants and all plants not in vigorous, thriving conditions as determined by the Owner's Representative during and at the end of the Warranty Period. Plants shall be free of dead or dying branches and branch tips and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species and shall be subject to all requirements of this specification.
D. Replacements shall be warranted through one (1) full growing season.

END OF SECTION

SECTION 32 91 00 TOPSOIL, PLACEMENT AND GRADING

PART 1-GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to furnishing and placing topsoil for finish grading for seeding, sodding and planting.

1.02 QUALITY ASSURANCE

Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

1.04 SUBMITTALS

A. Contractor shall provide required sample and soil analysis to Landscape Architect prior to delivery of any soil materials to site.
B. Topsoil test report for imported topsoil.
C. MicroLife Humates Plus 0-0-4

PART 2- MATERIALS

2.01 TOPSOIL: Contractor responsible for adding topsoil from off-site source if needed. Existing topsoil will be stockpiled by General Contractor for landscape use on site but must be uncontaminated and clean for landscape use.

ASTM D 5268, shall be fertile, friable, natural sandy loam surface soil with a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth and obtained from excavation or borrow operations having the following characteristics:

1. Ph value between 5.5 and 7.0
2. Liquid limit - topsoil not to exceed 50.
3. Plasticity index - 10 or less
4. Gradation - maximum of 40 % passing the No. 280 sieve.

A. On-site Topsoil Source: Reuse surface soil on-site if approved by Owner's Representative. Verify suitability of existing surface soil to produce topsoil. Supplement with imported or augmented topsoil from off-site sources when quantities are insufficient. Contractor responsible for testing topsoil (existing or imported) for compliance. Topsoil shall be free of subsoil, clay, lumps, weeds, weed seed, non-soil materials and other litter or contamination. Topsoil shall not contain roots, stumps, or stones larger than 1" inch.

Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other noxious weeds or high clay content.

B. Off-site Topsoil Source: Import enriched topsoil or manufactured topsoil from off-site sources. Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other noxious weeds.

2.02 SCHOOL SITE

A. Solid sod areas (see plan) shall receive 2" inch of topsoil before sodding.

2.03 AMENDMENTS

A. MicroLife Humates Plus 0-0-4
B. Compost – if topsoil needs additional organic material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate location of stockpile topsoil area with District and Project Manager.
B. Verify that excavation and subgrade operations have been completed to correct lines and grades and have been coordinated and reviewed by District, Project Manager, Civil Engineer and Landscape Architect.

3.02 PLACEMENT

A. Scarify and breakup subgrade.
B. Apply Humates at a rate of 10lbs per 1,000 sq ft. Process must be documented (video/photos) by contractor while applying product.
C. Spread topsoil in lifts according to plan grades.
D. Lightly roll or water topsoil and let topsoil settle.
E. Grade the surface of all areas to meet the grades shown on the civil drawings. Add enough topsoil to allow for settlement so soil will be at correct grades and achieve positive drainage after settlement.
    1. Provide for positive drainage from all areas toward the inlets and drainage structures.
    2. Provide even transitions.
    3. Cut grade where sod meets hydromulch for even level transition from one to the other.
    4. All grading must be reviewed by Project Manager, District, Civil Engineer and Landscape Architect.
    5. Fill all settlement depressions at no additional cost to Owner.
F. Coordinate this operation with other trades.

3.03 CLEAN UP

Remove spilled topsoil from paved areas, curbs, gutters, etc. As operations proceed all excess soil and debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times.

3.04 PROTECTION

Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

SECTION 32 92 00 - LAWN SODDING & HYDROMULCH

PART 1-GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, hydromulching and sodding areas, fertilizing, installation maintenance, clean-up, guarantee and replacement and other work related thereto. Including:

A. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization, vegetation buffer strips or patching and lawn areas.
B. Sod is defined as blocks, squares, strips of turf grass with adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.
C. A double row of sod shall be placed around all inlets within hydromulch areas.
D. A single row of sod shall be placed around all hard surfaces including all walks, drives, edge of building, etc.
E. Lawn is defined as ground covered with fine textured grass kept neatly mowed.
F. Hydromulch to be applied in all disturbed areas that are not planted with solid sod (including right-of-ways).

1.02 QUALITY ASSURANCE

A. Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.
B. Sod certification shall be submitted from the sod nursery as to grass species and stripping date.
C. Seed certification shall be submitted from the supplier for each type of seed specified.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

PART 2- MATERIALS

2.01 Project site includes hydromulch and Common Bermuda solid sod (see plan for each indicated area).

A. Hydromulch shall be accomplished according to the following schedule:

Summer application (April 1 - September 30) per 1000 square feet
50# wood cellulose fiber mulch
1.5# - 2# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Winter application (October 1 - February 14) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
2# gulf rye seed
15# 13-13-13 water soluble fertilizer

Late Winter/Early Spring application (February 15 - March 31) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Seed shall be certified 90 % pure and conform to the Federal Seed Act and Texas Seed Law.

Hydromulch to be applied at an accelerated schedule in order for the grass to grow prior to the start of school. Hydromulch must achieve full growth prior to Substantial Completion date.

B. Solid sod as called for on plans. Sod shall be certified or nursery/farm grown grass true to the name and variety. Sod shall be substantially free of noxious weeds, disease, insects, thatch and undesirable grasses.

Sod shall be nursery grown and have a healthy root system of dense thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch. Sod shall be rectangular in size approx 16”x24”.

Schedule deliveries to coincide with topsoil operations and laying. During wet weather allow sod to dry sufficiently to prevent tearing. During dry weather, protect sod from drying out. Water as necessary to insure vitality and to prevent excess loss of soil while handling. Sod which dries out will be rejected. Sod shall be cut delivered and installed within 24 hours of cutting.

C. Fertilizer – Organic Microlife 6-2-4

D. Bank Sand – Free of clay lumps, roots, grass, salt or other foreign material.

E. Humates – MicroLife Humates Plus 0-0-4 applied in ALL hydromulch areas and in TOPSOIL for landscape sod areas (See Topsoil Section 32 92 00)

PART 3 - EXECUTION

3.01 PREPARATION - Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding or hydromulch operations.

A. Protection
1. Take care and preparation in work to avoid conditions which will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.

B. Surface Preparation for hydromulch

1. Remove all existing weeds by hand or herbicide use. Remove top growth and roots.
2. Scarify small areas (less than 500sq ft) by hand raking to 3” deep to remove rocks and construction debris and break up compacted soil.
3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.

4. At each step continue to remove soil clods, rocks, weeds, roots and construction debris above and below grade.
5. Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to next phase.

C. Surface Preparation for solid sod
1. Remove all existing weeds by hand or herbicide use. Remove top growth and roots.
2. Scarify small areas (less than 500sq ft) by hand raking to 3” deep to remove rocks and construction debris and break up compacted soil.
3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.
4. At each step continue to remove soil clods, rocks, weeds, roots and construction debris above and below grade.
5. See TOPSOIL section for amended topsoil requirements. Add a minimum of two (2”) inches of topsoil as a setting bed for landscape sod.
6. Refine grades for positive drainage to area drains. Sod areas to be graded to achieve proper final elevations, eliminating all bumps, ridges or depressions to provide for smooth drainage.
7. Grades to be approved by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding.

3.02 INSTALLATION

A. Site Tolerances

Final grade after complete shall be one inch below top of adjacent pavement of any kind. Coordinate with Civil drainage plans for possible conflicts, such as sheet drainage across sidewalks, etc. Bring all conflicts to the Project Managers attention for resolution.

B. Hydromulch
1. Apply Humates at a rate of 10lbs per 1,000 sq ft Lightly rake to incorporate into soil. Process must be documented (video/photos) by contractor while applying product.
2. Apply seed with approved spray equipment and water (to keep moist) seeded areas.
3. Hydromulch to be applied at an accelerated schedule in order for the grass to grow prior to the start of school.
4. Reseed areas that do not show prompt germination. Bare areas must be less than 12" in any direction.
5. Hydromulch must achieve full growth prior to Substantial Completion date.

C. Solid sod
1. Lay sod in rows with staggered joints. Butt sections closely without overlapping or leaving gaps between sections. Topdress/Sand fill sod joints.
2. Lay single row of sod along all hard surfaces including pedestrian, vehicular, building perimeter, back of curbs and mow strips within hydromulch areas.
3. Lay a double row of sod around inlet drains within the hydromulch areas.
4. Cut sod where sod meets hydromulch for an even transition from one area to the other.
5. Sod blocks shall not prevent drainage away from the walk or create ponding issues.
6. On all slopes and detention pond, lay sod perpendicular to slope and secure every row with metal 2 pronged staples at a maximum of 2 feet on center. Drive staples flush with soil portion of sod.

7. Roll sodded areas in two directions perpendicular to each other. Repair and reroll areas with depressions, lumps or other irregularities.
8. Fertilize sod areas (dependant on time of year).
9. Water sodded areas immediately after sod laying to obtain moisture penetration through sod into top four (4") inches of soil.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and washing if necessary.

3.04 PROTECTION

Planting areas shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner.

3.05 INSTALLATION MAINTENANCE

A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of the Substantial Completion Review punch list.
B. Installation maintenance shall begin immediately after hydromulching or sodding and continue until all Substantial Completion punch list items are completed. Installation maintenance includes all watering operations (temporary irrigation and hand watering for 90 days). Contractor is responsible for temporary and/or hand watering for hydromulch establishment.
C. Hydromulch must achieve full growth with bare areas less than 12” in any direction.
D. Installation maintenance shall include watering, weeding, mowing and edging once a week, reseeding, removal of dead materials, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the grass free of insects and disease.

3.06 INSPECTION AND ACCEPTANCE

Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work and "punch list" items generated by Substantial Completion review.

3.07 WARRANTY PERIOD AND REPLACEMENTS

Contractor shall warrant unconditionally that grass planted under this contract will be healthy and in flourishing condition of active growth for two years from date of Substantial Completion.

Any delay in completion of planting operations which extends the planting into more than one season will extend the Warranty Period correspondingly.

Replace without cost to the Owner, and as soon as weather conditions permit, all dead grass as determined by the Owner’s Representative during and at the end of the Warranty Period. Replacements shall be warranted through one full growing season.

END OF SECTION

SECTION 33 05 13.00 – MANHOLES AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASME B 16.1 -Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 -Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270-Standard Specification for Mortar for Unit Masonry

E. ASTM C 443 -Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

F. ASTM C 478 -Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 -Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

H. ASTM C 1107 -Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

I. ASTM D 698 -Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-Ib/fr')

J. ASTM D 2665 -Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

K. ASTM D 2996 -Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

L. ASTM D 2997 -Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

M. AWWA C 213 -Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

N. American Association of State Highway and Transportation Officials (AASHTO)

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's data and details of following items for approval:
   1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.
   2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.
   3. Frames, grates, rings, and covers.
   4. Materials to be used in fabricating drop connections.
   5. Materials to be used for pipe connections at manhole walls.
   6. Materials to be used for stubs and stub plugs, if required.
   7. Materials and procedures for corrosion-resistant liner and coatings, if required.
   8. Plugs to be used for sanitary sewer hydrostatic testing.
   9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.

C. Seal submittal drawings by Professional Engineer registered in State of Texas.

PART 2 P R O D U C T S

2.1 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Owner’s Representative.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.
   1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs.
   2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
   3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.
   4. Intemalliquid pressure based on unit weight of 63 pcf.
   5. Dead load of manhole sections fully supported by transition and base slabs.

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:
   1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.
   2. Wall loading conditions:
      a. Saturated soil pressure acting on empty manhole.
      b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure.
   3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater.

G. Provide joints between sections with O-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

2.2 CONCRETE

A. Conform to requirements of Division 32.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4,500 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Division 31.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4,500 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.3 REINFORCING STEEL

A. Conform to requirements of Division 32.

2.4 MORTAR

A. Conform to requirements of City of Houston Standard Specifications Section 04061 – Mortar.

2.5 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Division 33.

2.6 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.7 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.
   1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:
      a. External clamps: Type 304 stainless steel.
      b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.

c. Internal, expandable clamps on corrosion-resistant manholes:
1) Type 316 stainless steel, 11 gauge minimum.
2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213.

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:
1. Provide watertight connections in accordance with ASTM C 923.

C. Water Lines
1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.
2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.8 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

B. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

C. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.9 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide one of following:
1. PVC liner for precast cylindrical manhole section, base sections, and cone sections in accordance with Division 33.
2. Precast base sections, as specified above, lined with PVC or equal and fiberglass manholes in accordance with Division 33.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Division 31.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:
   1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.
   2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive.
   3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.
   4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by The Engineer from manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of manholes, including adjustment of manholes to grade unless approved by the Engineer. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings.
   1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
   2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
   3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
   4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by the Engineer.

3.2 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.3 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Division 2.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify the Engineer for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24 inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.4 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

3.5 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.
   1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.
   2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split

waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.6 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
   1. Slope of invert bench: 1 inch per foot minimum; 1-1/ 2 inches per foot maximum.
   2. Depth of bench to invert:
      a. Pipes smaller than 15 inches: one-half of largest pipe diameter.
      b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter.
      c. Pipes larger than 24 inches: equal to largest pipe diameter.
   3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.7 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of four (4) inches outside bells.

B. Install drop connection when sewer line enters manhole higher than 30 inches above invert of manhole.

3.8 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.9 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 3 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Division 31. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over

each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32. When shown on Drawings, sod disturbed areas in accordance with Division 32.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Division 33.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to the Owner.

END OF SECTION

SECTION 33 05 13.13 – MANHOLE GRADE ADJUSTMENT

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.1 CONCRETE MATERIALS

A. Provide concrete, conforming to requirements of Division 33.

B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Division 33.

C. Provide mortar conforming to requirements of City of Houston Standard Specifications Section 04016 - Mortar.

2.2 CAST-IRON MATERIALS

A. Provide cast-iron materials conforming to requirements of Division 33.

2.3 PIPING MATERIALS

A. For riser pipes and fittings, refer to Division 33.

2.4 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

A. Provide brick masonry units conforming to the requirements of Division 32.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manager.

3.2 ESTABLISHING GRADE

A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

3.3 ADJUSTING MANHOLES AND INLETS

A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in Division 33.

B. Salvage and reuse cast-iron frame and cover or grate.

C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.

D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manger's approval.

3.4 ADJUSTING VALVE BOXES

A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manager. No separate pay.

B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.

C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.

D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

3.5 BACKFILL AND GRADING

A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Division 31.

B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.

C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32.

END OF SECTION

SECTION 33 05 16.13 – PRECAST CONCRETE UTILITY STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.5 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4,500 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:
   1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.
   2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Division 32.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Division 33.

2.2 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:
1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.
2. Surface defects indicating honeycombed or open texture.
3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Owner’s Representative, repaired units conform to requirements of these specifications.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.2 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Division 31.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.

3.3 FINISHES

A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.

B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.4 INLET WATERTIGHTNESS

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.5 CONNECTIONS

A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.6 BACKFILL

A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Division 31.

END OF SECTION

SECTION 33 05 16.16 - CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

BB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

CC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

DD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

EE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

II. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

JJ. CRSI MSP-1 - Manual of Standard Practice.

KK. CRSI - Placing Reinforcing Bars.

LL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

MM. NRMCA - Concrete Plant Standards.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Owner’s Representative.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.5 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.1 CONCRETE MATERIALS

A. Cementitious Material:
1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Owner’s Representative; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.
2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:
1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
2. Fine Aggregate: ASTM C 33.
3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:
1. Water Reducers: ASTM C 494, Type A.
2. Water Reducing Retarders: ASTM 494, Type D.
3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:
1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:
1. Fibrillated Polypropylene Fiber:
a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
b. Physical Properties:
1) Material: Polypropylene.
2) Length: 1/2 inch or graded.
3) Specific Gravity: 0.9l.
c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.
2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
b. Physical Properties:
1) Material: Steel.
2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1.
3) Specific Gravity: 7.8.
4) Tensile Strength: 40-400 ksi.
5) Young's Modulus: 29,000 ksi.
6) Minimum Average Tensile Strength: 50,000 psi.
7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking.

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.2 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.3 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.4 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.5 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Owner's Representative for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Owner's Representative.

D. Classification:

Class	Type	Minimum Compressive Strength (LBS/Sq.In.)		Maximum W/C Ratio	Air Content (Percent)	Consistency Range in Slump (Inches)
		7-Day	28-Day			
A	Structural	3200	4000	0.45	4 ± 1	2 to 4*
B	Pipe Block Fill, Thrust Block	---	1500	---	4 ± 1	5 to 7
*When ASTM C 494, Types F or Type G admixture is used to increase workability, this range may be 6 to 9.						

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.6 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:
1. Thickness: not less than 3/8 inch.
2. Acceptable Manufacturers:
   a. Kirkhill Rubber Co., Brea, California.
   b. Water Seals, Inc., Chicago, Illinois.
   c. Progress Unlimited, Inc., New York, New York.
   d. Greenstreak Plastic Products Co., St. Louis, Missouri.
   e. Approved equal.

2.7 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.

B. Bentonite Waterstop:
1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.
4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:
1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
2. Meets or exceeds requirements of Federal Specification SS-S-210A.
3. Supplied wrapped completely by 2 part protective paper.
4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.
6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

PART 3 E X E C U T I O N

3.1 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Owner’s Representative, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.2 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Owner's Representative and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Owner's Representative. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.3 .EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.4 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 through 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Owner's Representative before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Owner's Representative.

3.5 PLACING CONCRETE

A. Give sufficient advance notice to Owner's Representative (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Owner's Representative's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.6 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

C. Splicing PVC Waterstops:
   1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer's printed instructions.
   2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.
   3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inch long strips of waterstop material beyond joint. Upon inspection and approval by Owner's Representative, install

prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24 inch strips to straight-run portions of waterstop in forms.

D. Setting PVC Waterstops:
   1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
   2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.

F. Resilient Waterstop:
   1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
   2. When requested by Owner’s Representative, provide technical assistance by manufacturer's representative in field at no additional cost to City.
   3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
   4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.
   5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.
   6. Bentonite Waterstop:
      a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
      b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1 1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
      c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
      d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
      e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inch maximum spacing.
   7. Adhesive Waterstop:
      a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.
      b. If surface is too rough to allow waterstop to form complete contact, grind to

form adequately smooth surface.

c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.

d. Do not remove protective paper until just before final form work completion. Place concrete immediately. time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.7 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Owner's Representative. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.8 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Owner's Representative.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.
2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Owner's Representative. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.
2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.9 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Owner's Representative.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Division 1.

B. Unless otherwise directed by Owner's Representative, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.
1. Take concrete samples in accordance with ASTM C 172.
2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.
3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Owner's Representative, at no additional cost to City.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Owner's Representative.

END OF SECTION

SECTION 33 06 10.14 - POLYVINYL CHLORIDE (PVC) PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches through 48 Inches for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.

S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Owner’s Representative for review. Cost of testing paid by Contractor.

PART 2 P R O D U C T S

2.1 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.
   1. Pipe Material:
      a. DR 18: For restrained joints where shown on Drawings.
      b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.
   1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
   2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:
   1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
   2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
   3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

G. Do not use PVC in potentially or known contaminated areas.

H. Do not use PVC in areas exposed to direct sunlight.

2.2 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Owner's Representative.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.3 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

Wall Construction	Manufacturer	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range

Solid	J-M Pipe Certain Teed Diamond Uponor ETI North American	D3034	SDR 26 / PS 115	6” to 10”
		D3034	SDR 35 / PS 46	12” & 15”
		F679	SDR 35 / PS 46	18” to 27”
		AWWA C900	DR 18 / N/A	4” to 12”
		AWWA C909	DR 18 / N/A	4” to 12”
		AWWAC905	DR 18 / N/A	14” to 16”
Truss (Gasketed)	Contech	D2680	N/A / 200 psi	8” to 15”
Profile	Contech A-2000 Contech A-2026 ETI, Ultra-Rib ETI, Ultra-Corr	F949 F949 F794 F794	N/A / 46 psi N/A / 115 psi N/A / 46 psi N/A / 46 psi	12” to 36” 8” to 10” 8” to 30” 24” to 36”

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner’s Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.4 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Division 33.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Division 33, except furnish fittings with one of following approved internal linings:
   1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting.
   2. Nominal 40 mils (35 mils minimum) polyurethane.
   3. Nominal 40 mils (35 mils minimum) ceramic epoxy.
   4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy.

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Division 33.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.2E.

2.5 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 E X E C U T I O N

3.1 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.2 INSTALLATION

A. Conform to requirements of Division 33, as applicable.

B. Install PVC pipe in accordance with Division 33, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:
   1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.
   2. Water service pipe 16 inches in diameter and larger 5 feet of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.3 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:
   1. Perform by workers certified by manufacturer.
   2. Use a PVC pipe cutter and provide square ends.
   3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

SECTION 33 06 10.15 – DUCTILE IRON PIPE AND FITTINGS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Ductile iron pipe and fittings for water mains, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings, for Water and Other Liquids.

B. ANSI A 21.10 (AWWA C 110) - Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in., for Water and Other Liquids.

C. ANSI A 21.11 (AWWA C 111) - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Flanged Ductile-Iron Pipe with Threaded Flanges.

E. ANSI A 21.50 (AWWA C 150) - Thickness Design of Ductile-Iron Pipe.

F. ANSI A 21.51 (AWWA C 151) - Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.

G. ANSI A 21.53 (AWWA C 153) - Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for water service.

H. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

I. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.

J. ASTM G 62 - Test Methods for Holiday Detection in Pipeline Coatings.

K. AWWA C 600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

L. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.

1.4 SUBMITTALS

A. Conform to requirements of Section - Submittal Procedures.

B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by Engineer is at Contractor's risk.

1.5 QUALITY CONTROL

A. Provide manufacturer's certifications that all ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

B. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A 21.11.

PART 2 P R O D U C T S

2.1 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water mains and Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

2.2 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.15 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, bolts shall conform to requirements of AWWA C 111.

B. Where restrained joints for buried service are required by Drawings, provide one of the following, or equal:
1. Super-Lock Joint by Clow Corporation.
2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.
3. TR-Flex Joint by U.S. Pipe and Foundry Company.

C. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 33 13 00.10 - Hydrostatic Testing of Pipelines as applicable.

E. Where ductile iron water main is cathodically protected from corrosion, bond rubber gasketed joints as shown on Drawings to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

2.3 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed pipeline, shall have the following gasket materials for the noted contaminants:

Contaminant	**Gasket Material Required**
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by the pipe manufacture

2.4 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they serve.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI A 21.10; ANSI B 16.1 cast or ductile iron. Flanges: ANSI B 16.1, Class 125; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C 110); pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water Mains: ANSI A 21.53; 4-inch through 12-inch diameter; cement-mortar lining; conform to requirements Division 33 - Polyethylene Wrap.

2.5 COATINGS AND LININGS

A. Water Main Interiors: ANSI A21.4, cement lined with seal coat.

B. Sanitary Sewer and Force Main Interiors:
1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.
2. Liner thickness: Nominal 40 mils, minimum 35 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.
3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.
4. Acceptable Lining Materials:
   a. Virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage heat bonded to interior surface of pipe and fittings; APolyline@ by American Cast Iron Pipe Company; or equal.
   b. Polyurethane: Corro-pipe II by Madison Chemicals.
   c. Ceramic Epoxy: Protecto-401 by Enduron Protective Coatings.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior: Prime coat and outside asphaltic coating conforming to ANSI A 21.10, ANSI A 21.15, or ANSI A 21.51 for pipe and fittings in open cut excavation and in casings.

E. Polyethylene Wrap: For buried water lines and sanitary sewers, including point repairs, provide polyethylene wrap unless otherwise specified or shown. Provide polyethylene wrap for buried ductile iron pipe, including polyurethane coated pipe. Conform to requirements of Division 33 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified in the Phase II Environmental Site Assessment Report.

2.6 MANUFACTURERS

A. Pre-approved manufacturers of ductile iron pipe are American Cast Iron Pipe Co., McWayne Cast Iron Pipe Co., and U. S. Pipe and Foundry Co.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to installation requirements of Sections 33 11 00 - Water Utility Distribution Piping, and 33 31 00 – Sanitary Utility Sewerage Piping, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in polyethylene wrap, unless cathodic protection is provided. Do not use polyethylene wrap with a cathodic protection system.

3.2 GRADE

A. Unless otherwise specified on Drawings, install ductile iron pipe for water service to clear utility lines with following minimum cover:

Diameter (Inches)	Depth of Cover (Feet)
16 and 24	5
12 and smaller	4

END OF SECTION

SECTION 33 06 40.10 - HDPE SOLID AND PROFILE WALL PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. High density polyethylene (HDPE) pipe for gravity sewers and drains, including fittings.

B. High density polyethylene (HDPE) pipe for sanitary sewer force mains, including fittings.

C. High density polyethylene (HDPE) pipe for storm sewers culverts.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Drainage Pipe, 18"- 48" diameter.

B. AASHTO Section 18 - Soil Thermoplastic Pipe Interaction Systems.

C. AASHTO Section 30 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

D. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.

E. ASTM D 1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

F. ASTM D 2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.

G. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.

H. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

I. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

L. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

N. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of pipe and fittings, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Provide manufacturer's certificate of conformance to Specifications.

B. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

C. Owner’s Representative reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities to provide products that comply with applicable standards and these Specifications.
1. Manufacturer's Notification: Should Owner’s Representative wish to witness manufacture of specific pipes, manufacturer shall provide Owner’s Representative with minimum three weeks’ notice of when and where production of those specific pipes will take place.
2. Failure to Inspect. Approval of products or tests is not implied by Owner’s Representative's decision not to inspect manufacturing, testing, or finished pipes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience of minimum 5 years of pipe installations that have been in successful, continuous service for same type of service as proposed Work.

PART 2 P R O D U C T S

2.1 GENERAL

A. For sanitary sewer pipe provide HDPE pipe as follows:
1. NEW CONSTRUCTION PIPE PRODUCTS GRAVITY SANITARY SEWER DIRECT BURY:

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM or AASHTO	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02505	Solid Wall Polyethylene (HDPE)	Chevron Plexco Phillip 66 Quail Poly Pipe	ASTM F-714	DR 17 DR 21	115 46	8” – 10” 12” – 48”
02531	Polyethylene Profile Wall	Spirolite	ASTM F-894	n/a	46	18”–120”

2. REHABILITATION CONSTRUCTION PIPE PRODUCTS SLIPLINING OF SANITARY SEWER:

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE

02550	Solid Wall Poly	Chevron Plexco Quail Poly Pipe AmeriFlow by NAPCO Ameriflow by KWH	F-714	DR 21	46	8” – 48” 3” – 12” 14” – 63”
02550	Polyethylene Profile Wall	Spirolite	F-894	n/a	46	18”–120”

B. For Storm Sewer and Residential Driveway Culverts provide HDPE as follows:
   1. N-12 and N-12 HC by Advanced Drainage Systems, Inc. (ADS).
   2. Sure-Lok F477 by Hancor, Inc.

C. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

D. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

E. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

F. Furnish corrugated polyethylene pipe (CPP) for gravity storm sewer pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:
   1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged conforming to the requirements of ASTM F-477.

G. Jointing:
   1. Gaskets:
      a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.
      b. Pipes allowed to be installed in potentially contaminated areas, where free product is found near elevation of proposed sewer, shall have the following gasket materials for noted contaminants:

Contaminant	Gasket Material Required
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by pipe manufacturer

   2. Lubricant. Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.2 MATERIALS FOR SANITARY SEWER

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications.

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.3 MATERIALS FOR STORM SEWERS AND RESIDENTIAL DRIVEWAY CULVERTS

A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in AASHTO M 294, AASHTO MP7 and ASTM D 3350.

B. Types: CPP shall meet one or both of following:
1. Type S: Outer corrugated wall with smooth inner liner.
2. Type D: Inner and outer smooth walls braced circumferentially or spirally with projections or ribs.

C. Lubricant: Use lubricant for assembly of gasketed joints, which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.4 TEST METHODS FOR SANITARY SEWER

A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner’s Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2 inches per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to pipe's outer contour.

D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.5 TEST METHODS FOR STOMR SEWERS AND RESDENTIAL DRIVEWAY CULVERTS

A. Pipe stiffness at 5 percent deflection, when determined in accordance with ASTM D 2412, shall be as specified in Section 7.4 of AASHTO M 294.

B. Minimum inner wall thickness shall be as specified in Section 7.2.2 of AASHTO M 294.

2.6 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with following information:
1. Pipe size.
2. Pipe class.
3. Production code.
4. Material designation.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to requirements of Division 33.

B. Install pipe in accordance with the manufacturers recommended installation procedures.

C. HDPE pipe is not approved in applications requiring auguring of pipe.

D. Bedding and backfill: Conform to requirements of Division 31.

END OF SECTION

SECTION 33 06 40.11 – REINFORCED CONCRETE PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete pipe for storm sewers.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe.

C. ASTM C 497 - Method of Testing Concrete Pipe, Sections, or Tile.

D. ASTM C 506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.

E. ASTM C 507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

F. ASTM C 655 - Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.

G. ASTM C 822 - Standard Definitions and Terms Relating to Concrete Pipe and Related Products.

H. ASTM C 877 - Standard Specification for External Sealing Bands for Non circular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.4 SUSTAINABLE DESIGN (LEED) REQUIREMENTS

A. GENERAL LEED REQUIREMENTS: Reference Section 01 35 45 for general information regarding sustainable requirements for this LEED Silver Project.

B. LEED PROJECT CHECKLIST: Reference the *LEED Project Checklist* (included in Section 01 35 45) for an understanding of the project's LEED goals, including quantities and percentages within the required credits.

C. LEED SUBMITTAL PROCEDURE: All Subcontractor(s) and vendor(s) providing materials and products under this Section shall be REQUIRED to submit a fully-executed *Sustainable Product Submittal Sheet* (included in Section 01 35 45) regardless of whether credits are expected for materials and products provided under this Section.

1.5 SUBMITTALS

A. Submittals shall conform to requirements in Division 1.

B. Submit complete product data for pipe, fittings, and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that concrete pipes meet applicable standards when tested in accordance with ASTM C 497.

PART 2 P R O D U C T S

2.1 REINFORCED CONCRETE PIPE

A. Circular reinforced concrete pipe shall conform to requirements of ASTM C 76, for Class III wall thickness. Joints shall be rubber gasketed conforming to ASTM C 443.

B. Reinforced concrete arch pipe shall conform to the requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to the requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Joints shall be rubber gaskets conforming to ASTM C 877.

D. Reinforced concrete D-load pipe shall conform to the requirements of ASTM C 655.

2.2 GASKETS

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by the pipe manufacturer

2.3 SOURCE QUALITY CONTROL

A. Representatives of Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to requirements of the following Sections, as applicable:
1. 33 41 00 - Storm Utility Drainage Piping.

B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter water lines and large diameter water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.

B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel.

D. ASTM A 536 - Standard Specification for Ductile Iron Castings.

E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.

G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.

I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination.

K. ASTM E 709 - Standard Guide for Magnetic Particle Examination.

L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Submit photographs conforming to requirements of Division 1 prior to commencement of construction.

D. Submit videotapes conforming to requirements of Division 1, if applicable.

E. Submit Lone Star notification transmittal number prior to beginning excavation.

F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:
   1. Disinfection; not to exceed 4,000 linear feet per section.
   2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
   3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 P R O D U C T S

2.1 PIPE MATERIALS

A. Install pipe materials which conform to Division 33.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.

D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

2.2 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.

B. O-rings: Conform to National Sanitary Foundation requirements.

2.3 RESTRAINED JOINTS

A. Ductile-Iron Pipe: See Division 33.

B. PVC Pipe: See Division 33. Perform hydrostatic testing in accordance with ASTM F 1674.

C. Pre-stressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.6 D).

D. Restrained Joints where required on DIP and PVC pipe:
   1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24 inches, and ASTM A 36 for sizes greater than 30 inches. Working pressure rating twice that of design test pressure.
   2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

2.4 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings.
   1. Install where shown on Drawings or where allowed by Owner’s Representative for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.
   2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
   3. Provide approved flanged adapter couplings for steel pipe.
   4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of approved coal tar coating.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.
   1. Body and Flap: ASTM A 126-B cast iron.

2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.
3. Resilient Seat.
4. Hinge Arms: ASTM B 584-CA865 high tensile bronze.
5. Hinge pins: ASTM B 98-CA655 silicon bronze.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.

E. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Owner’s Representative before proceeding with construction.

F. Inform Owner’s Representative if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Owner’s Representative.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Owner’s Representative.

H. Only the appropriate governing agency will handle operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.

J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Owner’s Representative.

3.2 HANDLING, CLEANING AND INSPECTION

A. Handling:
   1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
   2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains,

hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
5. Use precautions to prevent injury to pipe, protective linings and coatings.
    a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
    b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
    c. Do not lift pipe using hooks at each end of pipe.
    d. Do not place debris, tools, clothing, or other materials on pipe.
6. Repair damage to pipe or protective lining and coating before final acceptance.
7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6 inches, measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:
    a. In surface laitance of centrifugally cast concrete.
    b. In sections of pipe with steel reinforcing collars or wrappers.
    c. Within 12 inches of pipe ends.
8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.3 EARTHWORK

A. Conform to applicable provisions of Division 31.

B. Bedding: Use bedding materials in conformance with Division 31.

C. Backfill: Use bank run sand or earth or native soil as specified in Division 31. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Owner’s Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 PIPING INSTALLATION

A. General Requirements:
    1. Lay pipe in subgrade free of water.

2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
3. Properly form bedding to fully support bell without wedging or blocking up bell.
4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Owner's Representative prior to skipping any portion of Work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Division 33 for additional requirements at critical locations.

E. Laying Large Diameter Water Line:
1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Owner's Representative. No additional payment will be made for higher class of pipe or improved bedding.
3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.
1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Owner's Representative and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Owner's Representative agrees key personnel, equipment and materials are on hand to complete Work.
2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Owner's Representative and the governing agency is present to observe.
4. Coordinate with the governing agency to obtain reduction in operating pressures prior to performing connections to existing piping.
5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Owner's Representative.

6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Division 1.
7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
8. Submit to Owner's Representative Lone Star Notification transmittal number prior to beginning excavation.
9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.
10. Provide adequate notice to pipe manufacturer's representative when connecting or modifying existing pre-stressed or pretension concrete cylinder pipe.
11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Division 1.
12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Owner's Representative by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.
13. No night work or plant shut down will be scheduled to begin two working days before or after designated Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide governing agency a minimum of two weeks' notice prior to shutting down existing water line.

3.6 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:
1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
5. Where preventing movement of 16-inch diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.
   a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
   b. Do not include passive resistance of soil in thrust restraint calculations.
6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Owner's Representative.

B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:
1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.

3. Use galvanized or black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.
4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City of Houston's "Approved Products List."
5. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):
1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.
2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.
3. Furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.
4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1 ½ inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.
5. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
6. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.
7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.
9. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.
10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.
11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.
12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.
13. Welded Joints for Large Diameter Water Lines:
    a. Furnish pipe with trimmed spigots and interior welds for 36-inch and larger pipe.
    b. Use exterior welds for 30 inch and smaller.
    c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 ½ degrees.

d. For large diameter water lines, employ an independent certified testing laboratory, approved by Owner's Representative, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Owner's Representative for review. Owner's Representative has final decision as to suitability of welds tested.
   1) Weld acceptance criteria:
      a) Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.
      b) Examine welded surfaces for the following defects:
         (1) Cracking.
         (2) Lack of fusion/penetration.
         (3) Slag which exceeds one-third (t) where (t) equals material thickness.
         (4) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.
         (5) Relevant linear indications in which length of linear indication exceeds three times its width.
         (6) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge.

14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.
16. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inches or greater.
    a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.
    b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.
    c. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.
    d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.
    e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe):
   1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.
   2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2-inch joint recess. Use joint "diapers" minimum of 12 inches wide.
   3. For field adjustments with deflections beyond manufacturer's recommendations:
      a. Field trim spigot.
      b. Do not engage ring.

4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.
5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints
1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks.
2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of pre-stressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Owner's Representative. Make adjustments in thrust restraint lengths at no additional cost to Owner.
3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
4. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.
5. Installation:
   a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
   b. Examine and clean mechanism; remove dirt, debris and other foreign material.
   c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
   d. Verify gasket is evenly seated.
   e. Do not over stab pipe into mechanism.
6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
7. Place 2500 psi concrete conforming to Division 32, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):
1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Re-tempering of grout by any means is not permitted.
2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without re-tempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.
3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
4. Follow established procedures for hot and cold weather concrete placement.
5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.
6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access

hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. Interior Joints for Pipe 24 inches and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Owner's Representative for 20-inch pipe and smaller.
8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.
9. Remove and replace improperly cured or otherwise defective grout.
10. Strike off grout on interior joints and make smooth with inside diameter of pipe.
11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.
12. Interior Joints for Water Lines 30 inches and Larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Owner's Representative of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.
13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to Owner.

H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Owner's Representative. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.
1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.
2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
4. Replace, repair, or reapply coatings and linings as required.
5. Assessment of deflection may be measured by Owner's Representative at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:

1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.
2. Fill exposed interior and exterior surfaces with non-shrink grout.
3. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.
4. For large diameter water lines, provide minimum overlap of 4 inches of butt strap over adjacent piece on butt-strap closures.

3.7 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Owner’s Representative.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.8 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.9 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.

B. Do not use polyethylene wrap if pipe is cathodically protected.

C. Conform to requirements of Division 33.

3.10 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Owner’s Representative, comply with the following:

1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.
2. No later than three days after completing disinfection preparatory work, execute disinfection work.
3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
4. Do not exceed a total of 50% of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Division 1.
5. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Division 1. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.11 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner’s Representative must inspect water line for cleanliness prior to filling.

3.12 DISINFECTION OF WATER LINES

A. Conform to requirements of Division 33.

3.13 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Division 33.

END OF SECTION

SECTION 33 12 13.10 - TAPPING SLEEVES AND VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

B. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service.

D. AWWA C 110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.

E. AWWA C 200 - Standard for Steel Water Pipe - 6 in. and Larger.

F. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply Service.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit results of tapping sleeves NPT test opening.

C. Submit manufacturer's affidavit as required in Division1.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Tapping Sleeves:
   1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
   2. Branch Outlet of Tapping Sleeve:
      a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
      b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
   3. Use cast iron split sleeve where fire service from 6-inch water line is approved.

B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
   1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.
   2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
   3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.
   4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.
   5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.
   6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.
   7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.
   8. Provide approved steel tapping sleeves.
   9. Tapping Sleeves: Provide with 3/4-inch NPT test opening for testing prior to tapping. Provide 3/4-inch bronze plug for opening.
   10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
   1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.
   2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.
   3. Stainless Steel sleeves are restricted to use on pipe sizes 4 inches and larger.
   4. Body: ASTM A240 Stainless Steel, Type 304.
   5. Bolts: ASTM A193 Stainless Steel, Type 304.
   6. Nuts: ASTM A194 Stainless Steel, Type 304.
   7. Branch Outlet: Heavy Stainless Steel Pipe.
   8. Provide approved stainless steel tapping sleeves.
   9. Do not use stainless steel sleeves for taps greater than 75 percent of pipe diameter.

D. Tapping Valves: Meet requirements of Division 33 with following exceptions:
   1. Inlet Flanges:
      a. AWWA C 110; Class 125.
      b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
   2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
   3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

E. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.

B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.

C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.

D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.

E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

3.2 INSTALLATION

A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.

B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.

C. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

D. Make tap with sharp, shell cutter:
1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.

E. Withdraw coupon and flush cuttings from newly-made tap.

F. Wrap:
1. For 12-inch and smaller tap, wrap completed tapping sleeve and valve in accordance with Division 2.
2. For 16-inch and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16 mils.

G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).

H. Request inspection of installation prior to backfilling.

I. Backfill in accordance with Division 31.

END OF SECTION

SECTION 33 12 13.12 – WET CONNECTIONS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Wet connections for new water mains and service lines to existing water mains.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.4 DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with installed valves, draining the isolated sections, and completing the connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Division 33 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements in Division 33.

C. Valves shall conform to requirements of Section 33 12 16 – Water Utility Distribution Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 E X E C U T I O N

3.1 CONNECTION OPERATIONS

A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify Engineer at least 48 hours in advance of making connections.

B. Do not operate valves on mains in use by Owner. Owner Representative will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Owner Representative is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.

3.2 2-INCH WET CONNECTIONS

A. Tap water main. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing main. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

END OF SECTION

SECTION 33 12 16 – WATER UTILITY DISTRIBUTION VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for proposed valves for approval.

C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.5 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends.

D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.

F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:
   1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
   2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
   3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
   4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
   5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.
   6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

I. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

J. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:
   1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.
   2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.
   3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
   4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.
   5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.
   6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.
   7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.

8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
9. Provide bypass for valves 24 inches and larger.
10. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
11. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
12. Stuffing Boxes: Located on top of bonnet and outside gear case.

K. Gate valves 14 inches to 24 inches: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.
1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.
2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.
3. Ensure wedge is symmetrical and seals equally well with flow in either direction.
4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.
5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.
6. Provide high strength bronze stem and nut.
7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.
8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.
9. Provide thrust washers to the thrust collar for easy valve operation.

L. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

M. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

N. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

O. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Earthwork. Conform to applicable provisions of Division 31.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.2 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve.

D. Assemble and brace box in vertical position as indicated on Drawings.

3.3 DISINFECTION AND TESTING

A. Assist Owner's Representative with disinfection of valves and appurtenances as required by Division 33 and test as required by Division 33.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bullheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.4 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground with approved paint.

END OF SECTION

SECTION 33 12 19 – WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

B. SSPC SP2 - Hand Tool Cleaning.

C. SSPC SP3 - Power Tool Cleaning.

D. SSPC SP10 - Near-White Blast Cleaning.

E. SSPC SP11 - Power Tool Cleaning to Bare Metal.

F. SSPC Paint Spec No.21.

G. SSPC-Paint 21 - White or Colored Silicone Alkyd Paint.

H. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II.

I. SSPC-Paint 104 - White or Tinted Alkyd Paint.

J. Federal Standard A-A-2962A - Enamel, Alkyd, Solvent Based Low VOC.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 P R O D U C T S

2.1 HYDRANTS

A. Provide approved fire hydrants.

B. The Owner’s Representative may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at Owner’s expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree (360) rotation of upper barrel.

2.2 LEADS

A. Branches (Leads): Conform to requirements of Division 33.

2.3 HYDRANT PAINTING

A. New hydrants and refurbished hydrants shall be shop coated as specified herein.

B. Exterior Above Traffic Flange (Including Bolts & Nuts):
1. Surface preparation to be in accordance with SSPC-SP 10 (MACE 2) near white blast cleaned surface.
2. Coat with three coat alkyd/silicone alkyd system with total dry film thickness (DFT) of 6 - 9 mils as follows:
a. Prime Coat - Oil modified alkyd primer, to be in general conformance with SSPC Paint Specification No. 25. Total dry film thickness (DFT) 2 - 3 mils.
b. Intermediate Coat - Heavy Duty Industrial Alkyd Enamel to be in general conformance with SSPC Paint Specification No. 104, and Federal Standard A-A-2962A. Total dry film thickness (DFT) of 2 -3 mils.
c. Finish Coat - Silicone Alkyd Resin Enamelto be in general conformance with SSPC Paint Specification No. 21. Total dry film thickness (DFT) to be 2 - 3 mils. Exception – hydrant bonnet shall not be finished shop coated, only intermediate coated. Install color coded finish coating of bonnet in field.
d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2 - 3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.
3. Colors - Primer: Manufacturers standard color. Finish coat of hydrant body: As specified by Owner. Connection caps: Finished coated white. Paint white band of finish coat two (2) inches in width on hydrant body approximately six inches (6") above and parallel to traffic flange. Intermediate coat: Contrasting color to blue finish, such as white.

C. Field Maintenance Painting (Exterior Above Traffic Flange):
1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC -SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint. Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC -SP11, Power Tool Cleaning to Bare Metal.
2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamelin general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3 - 6 mils.

D. Exterior Below Traffic Flange:
1. Surface preparation in accordance with SSPC- SP10 (MACE 2) Near White Blast Cleaned Surface.
2. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8 - 10 mils each for total DFT of 16 -20 mils.
3. Finish coat: Water based vinyl acrylic mastic Apply one coat with dry film thickness of 6 - 8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., blue. (Acro 555 Crystal Blue, or equivalent.)

E. Interior Surfaces Above and Below Water Line Valve:

1. Material used for internal coating of hydrant interior ferrous surfaces below water line valve must be NSF certified as suitable for contact with potable water as required by Chapter 290, Rules and Regulations for Public Water Systems, Texas Natural Resources Conservation Commission.
2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12 -18 mils.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Owner’s Representative) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Owner’s Representative.

D. Do not cover drain ports when placing concrete thrust block.

E. Obtain Owner’s Representative’s approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to nearest Utility Maintenance Quadrant Facility.

G. Install branches (leads) in accordance with Division 33.

H. Coating Requirements:
   1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
   2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.

I. Field coat hydrant bonnet to indicate size of water line supplying hydrant or tested flow at the fire hydrant as directed by the Fire Marshall or Owner.

J. Remove and dispose of unsuitable materials and debris in accordance with requirements of Division 1.

END OF SECTION

SECTION 33 12 40 - VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Valve boxes for water service.

B. Meter boxes for water service.

C. Meter vaults for water service.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturers' product data for following items for approval:
1. Each type of valve box and lid.
2. Each type of meter box and cover.
3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 P R O D U C T S

2.1 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe:
1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Division 33 or 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Division 33.
2. Provide single section of pipe.

E. Concrete for valve box placement:
1. For locations in new concrete pavement, provide strength and mix design of new pavement.
2. For other locations, provide concrete for sidewalks conforming to requirements of Division 32.

2.2 METER BOXES

A. Provide meter boxes as required by the governing authority and as shown on the drawings.

2.3 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.

B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.

C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.4 CONCRETE METER BOXES

A. Concrete Meter Boxes: Made of Class A concrete, with minimum 4,500 psi compressive strength, conforming to requirements of Division 32. Construct to dimensions shown on Drawings.

B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

2.5 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

ASTM	REQUIREMENT
D 256	Impact Strength = 1/9 ft.-lb./inch (Izod, Notched)
D 256	Impact Strength – 6.4 ft.-lb./inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 2240	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D 790	Flexural Modulus = 90,000 psi

B. Meter boxes shall meet the following test requirements:
1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8- inch.

3. Meter box body, without lid, shall weigh approximately 7 pounds.

2.6 METER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete, or common brick masonry unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Division 32 with minimum compressive strength of 4,500 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Division 32.

D. Grates and Covers: Conform to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Obtain approval from Owner's Representative for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.2 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.
1. Install with bell on top of valve.
2. Place riser pipe in plumb, vertical position.

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by Owner, repaint covers black.

3.3 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.

B. Construct concrete meter boxes to dimensions shown on Drawings.

C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Owner's Representative. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

3.4 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 12-inch-thick bed of cement stabilized sand conforming to requirements of Division 31.
2. Seal lifting holes with cement-sand mortar or non-shrink grout.

C. Meter Vault Floor Slab:
1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.
2. Precast floor slab elements may be used for precast vault construction.

D. Cast-in-Place Meter Vault Walls:
1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
3. Set frame for cover in concrete.

3.5 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
1. In unpaved areas, set top of meter box or meter vault cover 3 inches above natural grade. Grade area around vault to sheet flow away from vault.
2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch.

3.6 BACKFILL

A. Provide cement stabilized sand in accordance with Division 31 and backfill and compact in accordance with Division 31.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

SECTION 33 13 00.00 – DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disinfection of potable water lines.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to Public water distribution system.

B. Contractor shall provide water for disinfection at no additional charge to the Owner.

C. Unless otherwise provided in Contract Documents, Contractor will conduct disinfection operations.

D. Coordinate chlorination operations through Owner’s Representative.

3.2 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to Public water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Owner’s Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.3 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.
2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
4. Open and close valves in lines being sterilized several times during contact period.
5. If chemical compound is used for sterilizing agent, place in pipes as directed by Owner's Representative.

3.4 BACTERIOLOGICAL TESTING

A. Contractor is responsible for coordinating and paying for testing. Contractor shall provide, Owner, Architect and Engineer with test results.

B. After disinfection and flushing of water lines, bacteriological tests will be performed by the governing agency or testing laboratory in accordance with Division 1. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, the Contractor shall provide additional disinfection operations at no additional cost to the Owner.

3.5 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 13 00.10- HYDROSTATIC TESTING OF PIPELINES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Field hydrostatic testing of newly installed water pipelines.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to Public water distribution system.

C. Water for testing will be charged to Contractor in accordance with applicable Ordinances. Prior to hydrostatic testing, obtain a transient meter from the appropriate governing authority. Contractor shall pay all fees associated with transient meter.

D. Test pipelines in lengths between valves, or plugs, of not more than 4,000 feet.

E. Conduct hydrostatic tests in presence of Owner’s Representative.

3.2 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.

D. Fire water lines and mains may need to be pressure tested to 200 psi. Contractor shall coordinate requirements with local jurisdiction and local fire department.

E. Begin test by 9:00 a.m. unless otherwise approved by Owner’s Representative. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

F. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.3 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Owner's Representative for leakage during pressure test may be used to fulfill requirements of this section.

3.4 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Owner's Representative may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Division 33. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.

3.5 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 31 00.00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of Owner.

1.4 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Division 33.

B. Regulatory Requirements.
1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
2. Make notification to Owner’s Representative when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
3. Lay gravity sewer lines in straight alignment and grade.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Reinforced concrete pipe is not acceptable.

2.2 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in Division 33.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.3 APPURTENANCES

A. Stacks. Conform to requirements of Division 33.

B. Service Connections. Conform to requirements of Division 33.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.4 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.

C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Division 31 for excavations over 5 feet deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Owner’s Representative and agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Division 2.

F. Install and operate dewatering and surface water control measures in accordance with Division 1.

G. Do not allow sand, debris or runoff to enter sewer system.

3.2 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Owner’s Representative.

B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Owner's Representative so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Owner's Representative.

3.3 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Division 31.

3.4 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner's Representative.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 6-inch separation distance.

L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.5 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and micro-tunneling work as appropriate.

3.6 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Division 33.

B. Stacks. Construct stacks to conform to requirements of Division 33.

C. Construct manholes to conform to requirements of Division 33 as applicable. Install frames, rings, and covers to conform to requirements of Division 33.

3.7 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Division 33.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Division 33.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Division 33. Maintain piezometer installed to conform with Division 1until acceptance testing is completed.

3.8 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Division 31.

B. Backfill trench in specified lifts only after pipe installation is approved by Owner’s Representative.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Division 32.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and apply hydromulch according to requirements of Division 32.

E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and sod disturbed areas in accordance with Division 32.

3.9 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows

features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:
   1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
   2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.
   3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.

D. Provide video tapes on CD in a format compatible with Windows Media Player. Two labels are required. Place one label on the case and the other on face of each CD. Permanently label each video tape with following information.

Face of CD

Wastewater File No.: _____ Contractor's Name: _____
Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation
Tape No.: _____ Date Televised: _____ Date Submitted: _____
Basin No.: _____

CD Case

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

E. For each video tape provide completed TV Inspection Report, as attached at end of this section. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.

F. Upon completion of video tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

TELEVISION INSPECTION CODES

HEADER INFORMATION

LOCATION CODES

A	STREET ROW, HEAVY TRAFFIC
B	STREET ROW, LIGHT TRAFFIC
C	EASEMENT, POOR ACCESS
D	EASEMENT, GOOD ACCESS
E	PARKING LOT, POOR ACCESS
F	PARKING LOT, GOOD ACCESS
G	ALLEY, POOR ACCESS
H	ALLEY, GOOD ACCESS
I	OPEN AREA, POOR ACCESS
J	OPEN AREA, GOOD ACCESS

SURFACE COVER

A	ASPHALT STREET
B	CONCRETE STREET
C	SHELL STREET
D	SIDEWALK B (2)
E	TREES/SHRUBS
F	CLOSE TO FENCE
G	OPEN AREA E (5)
H	MOVABLE BUILDING
I	UNMOVABLE BUILDING
J	OVERHEAD UTILITIES
K	WATERWAY OR RAILWAY
L	HIGHWAY OR RUNWAY
M	PIPE ABOVE GROUND

PIPE TYPE

ABS	ACRYLONITRILE BUTADIENE STYRENE
BRK	BRICK
CIP	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CON	POURED IN PLACE CONCRETE
CPP	CURED IN PLACE PIPE
DIP	DUCTILE IRON PIPE
FRP	FIBERGLASS REINFORCED PIPE
PLP	PLASTIC LINE CONCRETE PIPE
PEP	POLYETHYLENE PIPE
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
RPM	REINFORCED PLASTIC MORTAR PIPE
URC	UNREINFORCED CONCRETE PIPE
VCP	VITRIFIED CLAY PIPE

WEATHER CODES
DRY - WET

CODE DESCRIPTIONS

CRACKS

RC-RADIAL LC-LONGITUDINAL F

CODES	DESCRIPTION	USE IN
A (1)	< ½" W, 1' L	CRK
B (2)	< ½" W, 1' – 2' L	CRK
C (3)	< ½" W, >2' L	CRK
D (4)	> ½" W, < 1' L	CRK
E (5)	> ½" W, 1' – 2' L	CRK
F (6)	> ½" W, > 2' L	CRK
G (7)	HOLE IN PIPE – SMALL	
H (8)	PIPE MISSING - < 60º	
I (9)	PIPE MISSING - > 60º	

JOINTS
MJ – MISALIGNED JOINT BJ-BROKEN JOINT

DESCRIPTION		USE IN
A (3)	DRP JT > 90% CLEAR	MJ
B (6)	DRP JT 80 – 90% CLEAR	MJ
C (9)	DRP JT < 80% CLEAR	MJ
D (3)	SHF JT > 90% CLEAR	MJ
E (6)	SHF JT 80 – 90% CLEAR	MJ
F (9)	SHF JT < 80% CLEAR	MJ
G (1)	WD JT 2" – 3"	MJ
H (2)	WD JT 3" – 4"	MJ
I (3)	WD JT > 4"	MJ
J (2)	BRK JT – LIGHT	BJ
K (4)	BRK JT – MEDIUM	BJ
L (6)	BRK JT – HEAVY	BJ
N (0)	VISIBLE GASKET	MJ
O (0)	LEAKING AT JOINT	MJ

LATERALS (L)

CODES	DESCRIPTION
A (1)	PRT SER 0" – 1"
PRT SER 1" – 2"	
C (3)	PRY SER 2" – 3"
D (4)	PRT SER 3" +
EFECTI E – SERVICE CONN.	
F (6)	DEAD/UNUSED SERVICE
G (7)	FACTORY SERVICE
H (0)	PLUMBER SERVICE

ROOTS (R)

CODES	DESCRIPTION
A (1)	ROOTS - LIGHT
B (2)	ROOTS - MEDIUM
C (3)	ROOTS – HEAVY

DEBRIS (D)

CODES	DESCRIPTION
A	DEBRIS - LIGHT
B	DEBRIS - MEDIUM
C	DEBRIS - HEAVY
D	GREASE - LIGHT
E	GREASE - MEDIUM
F	GREASE – HEAVY

INFLOW/INFILTRATION (I)

CODES	DESCRIPTION
A (3)	I/I – LIGHT (0-1 GPM)
B (6)	I/I – MEDIUM (1-5 GPM)
C (9)	I/I – HEAVY (> 5 GPM)
D (2)	I/I – SOME EVIDENCE
E (4)	I/I – CONSIDERABLE EVIDENCE
F (6)	I/I – GREAT EVIDENCE
G (0)	I/I – NO EVIDENCE

ALIGNMENT (A)

DESCRIPTION	
A	BEGIN ¼ PIPE WATER
B	BEGIN ½ PIPE WATER
C	CAMERA UNDERWATER
D	END CAMERA UNDERWATER
E	END ½ PIPE WATER

END ¼ PIPE WATER

STRUCTURAL
DS-DETERIORATED; OS-OVALITY; CS COLLAPSED

CODES	DESCRIPTION	USE IN
A (3)	LINE DET – LIGHT	DS
B (6)	LINE DET – MEDIUM	DS
C (9)	LINE DET – HEAVY	DS
D (3)	OVAL < 5%	OS
E (6)	OVAL > 5% & < 10%	OS
F (9)	OVAL > 10%	OS
G (9)	COLLAPSED	CS
H (0)	PIPE DET – HEAVY	DS
L (0)	PIPE DET – LIGHT	DS
M (0)	PIPE – MEDIUM	DS
N (0)	PIPE DET – NONE	DS
O	LINE DET – NONE	DS
Z (0)	AT MANHOLE NUMBER	CS

END OF SECTION

SECTION 33 31 00.10 - ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:
1. Visual inspection of sewer pipes.
2. Mandrel testing for flexible sewer pipes.
3. Leakage testing of sewer pipes.
4. Leakage testing of manholes.
5. Smoke testing of point repairs.
6. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.

B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

E. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Maximum allowable leakage for Infiltration or Exfiltration:
1. The total exfiltration, as determined by hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at minimum test head of 2 feet above crown of pipe at upstream manhole or 2 feet above groundwater elevation, whichever is greater.
2. When pipes are installed more than 2 feet below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above crown of pipe at upstream manhole.
3. Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

D. Perform air testing in accordance with requirements of this Section and Texas Natural Resources Conservation Commission requirements. Refer to Table 33 31 00.10-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test, and Table 33 31 00.10-4, Vacuum Test Time Table, at end of this Section.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Owner's Representative. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.6 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Provide testing reports and video tape of television inspection as directed by Owner's Representative.

C. Upon completion of tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

1.7 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.

B. Coordinate testing schedules with Owner's Representative. Perform testing under observation of Owner's Representative.

PART 2 P R O D U C T S

2.1 DEFLECTION MANDREL

A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.

C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 30 31 00.10-5, Pipe vs. Mandrel Diameter, at end of this

Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Owner's Representative.

2.2 EXFILTRATION TEST

A. Water Meter: Obtain transient water meter from appropriate governmental agency for use when water for testing will be taken from public system. Conform to governmental agency requirements for water meter use.

B. Test Equipment:
1. Pipe plugs.
2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.3 INFILTRATION TEST

A. Test Equipment:
1. Calibrated 90 degree V-notch weir.
2. Pipe plugs.

2.4 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:
1. Control panel.
2. Low-pressure air supply connected to control panel.
3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
4. Air hoses from control panel to:
a. Air supply.
b. Pneumatic plugs.
c. Sealed line for pressuring.
d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.5 GROUND WATER DETERMINATION

A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.6 SMOKE TESTING

A. Equipment:
1. Pneumatic plugs.
2. Smoke generator as supplied by Superior Signal Company, or approved equal.
3. Blowers producing 2500 scfm minimum.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Division 1.

3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.

B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test Options:
1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
4. If no installed piezometer is within 500 feet of sewer segment, provide temporary piezometer for this purpose.

B. Compensating for Ground Water Pressure:
1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.

C. Exfiltration test:
1. Determine ground water elevation.
2. Plug sewer in downstream manhole.
3. Plug incoming pipes in upstream manhole.
4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
1. Determine ground water elevation.

2. Plug incoming pipes in upstream manhole.
3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
4. Allow water to rise and flow over weir until it stabilizes.
5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 33 01 30-2.
1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
3. For pipe sections less than 36-inch average inside diameter:
   a. Determine ground water level.
   b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
   c. After manhole-to-manhole section of sanitary sewer main has been slip-lined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
   d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 33 31 00.10-2 at end of this Section.
   e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 33 31 00.10-2 at end of this Section for pipe diameter and length. For slip-lining, use diameter of carrier pipe.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.5 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:
1. Times in Table 33 31 00.10-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Natural Resources and Conservation Commission (TNRCC) Design Criteria 317.2(a)(4)(B).

		$T = 0.0850(D)(K)/(Q)$
Where:	T =	Time for pressure to drop 1.0 pounds per square inch gauge in seconds
	K =	0.000419 DL, but not less than 1.0
	D =	Average inside diameter in inches
	L =	Length of line of same pipe size in feet
	Q =	Rate of loss, 0.0015 ft^3/min./sq. ft. internal surface

2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test.
   a. Notes:
      1) When two sizes of pipe are involved, compute time by ratio of lengths involved.
      2) Lines with 27-inch average inside diameter and larger may be air tested at each joint.

3) Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4) If joint test is used, perform visual inspection of joint immediately after testing.
5) For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.6 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:
1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 33 31 00.10-4, Vacuum Test Time Table.
3. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Perform hydrostatic exfiltration testing as follows:
1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:
1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for slip-lined sections.

E. Smoke Introduction:
1. Operate equipment according to manufacturer's recommendation and as approved by Owner's Representative.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Owner's Representative.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 33 31 00.10-1

WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FEET
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

Table 33 31 00.10-2
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in.)	Min. Time	Length For Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	35:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64.38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

Table 33 31 00.10-3
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

Table 33 31 00.10-4
VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48”	60”	72”
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0
*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)			

Table 33 31 00.10-5
PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

END OF SECTION

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.4 QUALITY ASSURANCE

A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Owner’s Representative or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.2 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in Division 33 and as shown on the Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials that conforming to requirements specified Division 33 and as shown on the Drawings.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.3 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

C. Use cement stabilized sand material for bedding and backfill in the pipe zone for all storm sewers.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Owner’s Representative and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Division 2.

E. Install and operate dewatering and surface water control measures in accordance with Division 1.

3.2 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Owner’s Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use of appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 6 inches.

3.3 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.

D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Owner's Representative, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:
   1. Provide a minimum cover as per manufacturer's requirements from top of pavement to top of pipe, but no less than 2 feet.
   2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.
   3. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Owner's Representative. Field modify pipe per manufacturer's recommendations.
   4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.
   5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.4 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Division 33 where required.

B. Not allowed for plastic sewer pipe.

3.5 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Division 33. Install frames, grate rings, and covers to conform to requirements of Division 33.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars.

C. Install inlets, headwalls, and wingwalls to conform to requirements of Division 33.

D. Rehabilitate existing manholes to conform to requirements of Division 33. Adjust manhole covers and inlets to grade conforming to requirements of Division 33.

E. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.6 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Division 33. Hand held cameras may be used in storm sewers in lieu of requirements Division 33. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.7 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Owner's Representative.

B. Backfill and compact soil in accordance with Division 31.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Division 32.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Division 32 as required.

END OF SECTION

SECTION 33 49 13 – STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AASHTO -American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges.

B. ASTM A 48 -Standard Specification for Gray Iron Castings.

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. AWS -D 12.1 Welding Reinforcing Steel.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.1 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306-40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.

D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

2.2 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.3 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.4 FINISH

A. Unless otherwise specified, uncoated cast iron.

2.5 FABRICATED RING GRATE

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.6 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming to Division 33 requirements.

B. One piece casting with dimensions to fit frame and cover.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, "Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch". Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION