

09.24.2025

Project Manual

September 24, 2025

STANTEC Project No. 21400 1246

FBISD BP022 Gym Renovations & Additions

Fort Bend Independent

School District

Sugar Land, Texas

100% Construction Documents

Issue for Bid and Permit

Volume 1 of 2

All required Permits must be obtained before Construction

SECTION 00 01 01 – PROJECT TITLE PAGE

TITLE AND LOCATION OF THE WORK:

FBISD BP022 – Gym Renovations & Additions

NAME AND ADDRESS OF THE OWNER:

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



09.24.2025

ARCHITECT AND CONSULTANTS:

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TECHNOLOGY ENGINEER
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Houston, TX 77027
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PEA GROUP
LANDSCAPE ARCHITECT
16060 Dillard Dr, Suite 250
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TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
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.

Section	Title
00 01 01	Project Title Page
00 01 10	Master Table of Contents – Volumes 1and 2
*00 01 11	Sealed Structural Table of Contents
*00 01 12	Sealed MEP Table of Contents
*00 01 12.01	Sealed Technology Table of Contents
*00 01 13	Sealed Civil Table of Contents
*00 01 14	Sealed Landscape Table of Contents
00 01 15	List of Drawings – refer to Sheets G001-HGES, G001-PES, G001-RES, and G001-RPES

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*Fort Bend ISD CSP Advertisement for Competitive Sealed Proposals
*Fort Bend ISD CSP Instructions to Bidders
*Fort Bend ISD General Provisions for Purchasing Solicitations and Contracts
*Fort Bend ISD Package A Base Bid Proposal Form
*Fort Bend ISD Package B Alternates Bid Proposal Form
*Fort Bend ISD Clarification for Package B of Fort Bend ISD CSP
*Fort Bend ISD District Required Forms for CSP
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 Insured Parties)
Govt. Code 2270.002, Relationships With Foreign Entities (Required)
Addenda Acknowledgement Form (Required)
*Fort Bend ISD Bonding Capacity Certification Letter *(Required)*
*Fort Bend ISD Conflict of Interest Questionnaire



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*00 31 26	Asbestos Reports – Hunters Glen, Palmer & Ridgegate ES	Owner Document
*00 31 32	Geotechnical Data – Hunters Glen, Palmer & Ridgegate ES	Owner Document

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*00 40 02	General Conditions of the Contract for Construction	Owner Document
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*01 21 00	Allowances	Owner Document
*01 22 00	Unit Prices	Owner Document
*01 23 00	Alternates	Owner Document
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*01 26 00	Contract Modification Procedures	Owner Document
*01 29 00	Payment Procedures	Owner Document
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*01 55 26	Traffic Control	Owner Document
*01 56 39	Temporary Tree and Plant Protection	Owner Document
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*01 57 21	Indoor Air Quality Controls	Owner Document
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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.

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05 40 00 – Cold-Formed Metal Framing

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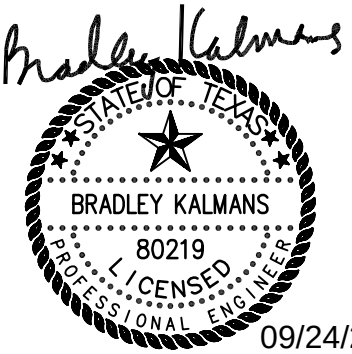
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INSPIRE • EQUIP • IMAGINE

Fort Bend Independent School District

Competitive Sealed Proposal for

BP022 Gym Renovations and Additions
CSP 26-003KB

Package "A" Base Bid and all documents except Alternates & SBE documents.
DUE NO LATER THAN 2:00 PM Central Time (CST) October 28, 2025

Package "B" Alternates and Package "C" SBE
DUE NO LATER THAN
3:00 PM Central Time (CST) October 28, 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/

Signed by: Nancy Lant F77F1A85ABE744F... 9/19/2025
Signed by: Ryan J. Eifler 1F973D1CC91A41D... 9/19/2025
Signed by: Brenda Garcia F7F6BD96D7C742E... 9/19/2025
Signed by: DF25ADA7E416421... 9/19/2025

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BP022 Gym Renovations and Additions
CSP 26-003KB

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 Elementary School Gym Additions/Renovations (BP022). The estimated construction cost of work for this project is **Twelve Million, One Hundred Thousand Dollars. ($12,100,000.00).**

PRE-PROPOSAL CONFERENCE:

A pre-proposal conference will be held on **Tuesday, October 7, 2025 at 2:00 PM (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: Kathleen Booker at kathleen.booker@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 **Wednesday, October 8, 2025, 9:00 AM (CST)**.
The pre-proposal walk will begin at Hunters Glen ES and then proceed to the other 3 campuses in the following order: Ridgegate ES, Rosa Parks ES, and conclude at Palmer ES.

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 **Monday, October 13, 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.

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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).

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Scope of Work

FBISD is seeking a contractor to provide a turnkey solution as well as addition/renovation scope at four (4) Elementary School campuses (BP022). The scope of work also includes but not limited to:

- Hunters Glen ES: New Gym addition and associated MEP scope and site improvements, including relocation of existing swings.
  Renovation of existing Gym/ELP building. Interior renovations (paint, wall covering).
- Palmer ES: New Gym addition and associated MEP scope and site improvements, including improvements at Hardtop Play surface (Restriping, Shade Cover Renovations).
  Install new Lower-level Playground and provide metal roof canopy.
  Provide irrigation around the main building perimeter.
  Renovation of existing Gym/ELP building. Interior renovations (paint, floor + wall covering).
- Ridgegate ES: Renovation of existing Gym/ELP building to New Gymnasium space.
  Interior lighting and lighting controls upgrades at existing building.
  Interior renovations (paint, wall coverings) + (replace casework at select classrooms).
- Rosa Parks ES: Install new Lower-level Playground and provide metal roof canopy at new and existing playgrounds. Provide irrigation around the main building perimeter.
  Replace existing Stage Curtain.

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 K-12 Elementary School Gym Addition/Renovation scope at approximately $12,100,000.

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

Senior Buyer: Kathleen Booker
Email: kathleen.booker@fortbendisd.gov

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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 points**

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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)	9/28/2025
2.	Job advertises (2nd run)	10/5/2025
3.	Pre-Proposal Conference 2:00 PM (CST)	10/7/2025
4.	Final Questions due 10:00 AM (CST)	10/13/2025
5a.	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.	10/28/2025
5b.	Proposal Package "B" Due **3:00 PM (CST) Alternates only**	10/28/2025
5c.	Proposal Package "C" Due **3:00 PM (CST) SBE documents only**	10/28/2025
6.	Presentation to Board of Trustees for contract award (Tentative, subject to change)	01/2026
7.	Tabulations and awards posted to https://fortbendisd.bonfirehub.com/portal/?tab=pastOpportunities	01/2026
8.	Substantial Completion of the Work	11/01/2027

SUBMISSION DEADLINE:

Fort Bend ISD will accept proposals submitted electronically through Bonfire e-bidding portal until **Tuesday, October 28, 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, October 28, 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.

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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.

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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.

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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.

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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.

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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

---

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: 26-003KB **BP** 022 - **BP Name:** BP022 Gym Renovations and Additions

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 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, Inc. dated 9/24/2025 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: Gym Addition/Renovation Scope and associated site improvements, as well as interior renovation scope at 4 Elementary School campuses: Hunters Glen, Palmer, Ridgegate, and Rosa Parks Elementary schools

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 423 calendar days to complete. Contractor agrees the work will be substantially completed within 423 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 022_____

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 No Allowance
B. $ N/A No Allowance

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	☐24" Diameter	_____	Each (EA)
02	☐30" Diameter	_____	Each (EA)
03	☐36" Diameter	_____	Each (EA)
04	☐42" Diameter	_____	Each (EA)
05	☐48" Diameter	_____	Each (EA)
06	☐54" Diameter	_____	Each (EA)
07	☐60" Diameter	_____	Each (EA)
08	☐66" Diameter	_____	Each (EA)
09	☐72" Diameter	_____	Each (EA)
10	☐84" Diameter	_____	Each (EA)

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 – MISCELLANEOUS STEEL

B. Provide unit pricing for the following miscellaneous steel work:

06	☐ Add/Delete Equal Leg Angles – L4X4X5/16	_____	Lin. Foot (LF)
07	☐ Add/Delete LLV Angles – L6X4X5/16	_____	Lin. Foot (LF)
08	☐ Add/Delete Channels – C8X11.5	_____	Lin. Foot (LF)

09	☐ Add/Delete HHS Tubes – HSS6X6X3/8	_____ Lin. Foot (LF)
10	☐ Add/Delete LSV Tube – HSS12X8X1/2	_____Lin. Foot (LF)
11	☐ Add/Delete Round Tube – 6"STD Pipe	_____ Lin. Foot (LF)
12	☐ Add/Delete Wide Flange – W14X22	_____Lin. Foot (LF)
13	☐ Add/Delete Steel Plate – 3/8" Thick	_____ Each (EA)

UNIT PRICES – ELECTRICAL POWER

C. 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

A. 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 Low voltage light switch	_____ Each (EA)
04	☐ Add/Delete Two-Way Light Switch	_____ Each (EA)
05	☐ Add/Delete Three-Way Light Switch	_____ Each (EA)
06	☐ Add/Delete J-Box with 1-1/4" Conduit stubbed to above ceiling	_____ Each (EA)

UNIT PRICES – DATA

A. Provide unit pricing for the following electrical work:

01	☐Add/Delete Data Port Wired to Nearest IDF/MDF	_____Each (EA)
02	☐Add/Delete Motion Sensor wired back to nearest intrusion expansion panel	_____Each (EA)
03	☐Add/Delete Card reader door wired back to nearest access control panel	_____Each (EA)
04	☐Add/Delete Additional PA speaker connected to common zone loop	_____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: 26-003KB **BP** 022 - **BP Name:** BP022 Gym Renovations and Additions

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, Inc. dated 9/24/2025 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: Gym Addition/Renovation Scope and associated site improvements, as well as interior renovation scope at 4 Elementary School campuses: Hunters Glen, Palmer, Ridgegate, and Rosa Parks Elementary schools

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 423 calendar days to complete. Contractor agrees the work will be substantially completed within 423 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 022_____ Base Proposal

BP 022. _____ Alternates
BP 022. _____ 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. No Allowance
B. $ N/A. No Allowance

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. 3A: Palmer ES - Metal Canopy at Playground

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 No. 3B Palmer ES - Fabric Canopy at Hardtop Play Area

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 ☐

   _____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. 4 Rosa Parks ES - Stage Curtains

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:

   _____

VI. UNIT PRICES – ALTERNATE BID

UNIT PRICES – Add Description

01	☐ add description	_____	add unit
02	☐ add description	_____	add unit
03	☐ add description	_____	add unit
04	☐ add description	_____	add unit
05	☐ add description	_____	add unit

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

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

Addenda Acknowledgement *(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 <u>only</u> acceptable format for the Surety's Bonding Capacity Certification Letter.

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

SURETY COMPANY

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

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).

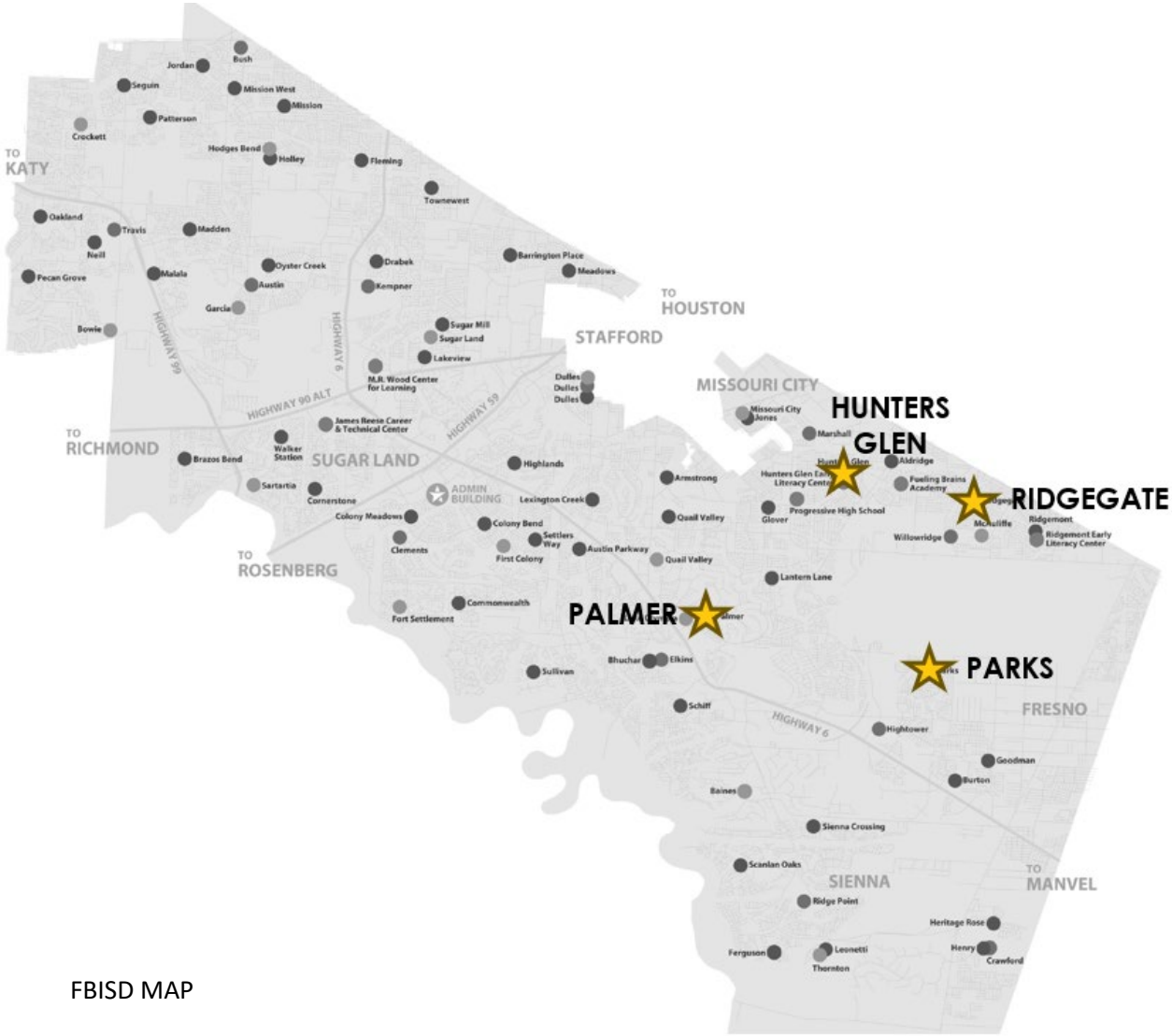
C. Project schedule including design and construction milestones and Owner's occupancy requirements is available by request. General Project information is located in section 01 10 00 “Summary of Work”.

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.

BP022 Gym Renovations and Additions			
Procurement	**96 days**	**Sun 9/28/25**	**Mon 2/9/26**
First Advertisement	1 day	Sun 9/28/25	Sun 9/28/25
Second Advertisement	1 day	Sun 10/5/25	Sun 10/5/25
Pre-Bid Meeting	1 day	Tue 10/7/25	Tue 10/7/25
Pre-Bid Walk	1 day	Wed 10/8/25	Wed 10/8/25
Last Day Q&A	1 day	Mon 10/13/25	Mon 10/13/25
Last Day Addendum	1 day	Tue 10/21/25	Tue 10/21/25
Open Bids	1 day	Tue 10/28/25	Tue 10/28/25
BOT Meeting/Approval	1 day	Mon 1/26/26	Mon 1/26/26
GC Contract+PO	10 days	Tue 1/27/26	Mon 2/9/26
Construction	**423 days**	**Mon 3/2/26**	**Mon 11/1/27**
NTP to GC	0 days	Mon 3/2/26	Mon 3/2/26
Submittals and Material Ordering	60 days	Mon 3/2/26	Fri 5/22/26
Construction	363 days	Mon 5/25/26	Mon 11/1/27
Substantial Completion	0 days	Mon 11/1/27	Mon 11/1/27

Exhibit A – Preliminary Schedules | Project Location Map



FBISD MAP

Exhibit B – Preliminary Construction Timeline

BP 022 - Gyms Renovation / Addition
Issue for Bid and Permit

FBISD BP022 - SCOPE OF WORK - PRELIMINARY CONSTRUCTION TIMELINE

NTP: 3/02/26 — SC: 11/01/27

| | | |

ASBESTOS CONTAINING MATERIALS SURVEY

FORT BEND ISD - BOND PACKAGE 022 - GYM RENOVATION
HUNTER GLEN ELEMENTARY SCHOOL

695 INDEPENDENCE BLVD.
MISSOURI CITY, TEXAS 77489

ECS PROJECT NO. 51:51-5007

FOR: FORT BEND INDEPENDENT SCHOOL DISTRICT

AUGUST 21, 2025

Geotechnical • Construction Materials • Environmental • Facilities

August 21, 2025

Ms. Nancy Lane
Fort Bend Independent School District
555 Julie Rivers Drive
Sugarland, Texas 77478
nancy.lane@fortbendisd.gov

ECS Project No. 51:51-5007

Reference: Asbestos Containing Materials Survey, Hunter Glen Elementary School, 695 Independence Blvd., Missouri City, Texas 77489

Dear Ms. Lane:

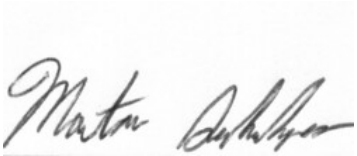
ECS Southwest, LLP (ECS) is pleased to provide Fort Bend Independent School District with the results of the above referenced Asbestos Containing Materials Survey performed at Hunter Glen Elementary School located at 695 Independence Blvd. in Missouri City, Texas 77489. This report summarizes our observations, analytical results, findings, and recommendations related to the work performed. The work described in this report was performed by ECS in general accordance with the Scope of Services described in ECS Proposal Number 51:7838 and the terms and conditions of the agreement authorizing those services.

ECS appreciates this opportunity to provide Fort Bend Independent School District with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Southwest, LLP





Quinton Ayers
Environmental Project Manager
QAyers@ECSLimited.com
202-993-2583

Martin Dehlinger
Department Manager, Associate Principal
MDehlinger@ECSLimited.com
832-993-6476

EXECUTIVE SUMMARY

The subject property consists of a one-story elementary school located at 695 Independence Blvd., in Missouri City, Fort Bend County, Texas 77489. The structure consists of 79,102 square feet and was reportedly originally constructed in 1993. At the time of the survey, the subject building was occupied by essential staff during summer break and is currently scheduled to be renovated as part of Bond Package 022 “Gym Renovation”.

The purpose of the survey was to determine if asbestos-containing materials (ACMs) are present within the client specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email. The survey was performed within representative interior areas of the subject building only.

ECS performed its survey of the elementary school on Monday July 28, 2025. Quinton Ayers, a Texas Department of State Health Services (TDSHS) Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. Bulk samples were submitted to Southeastern Environmental Microbiology Laboratories (SEEML) in Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology.

A total of 24 bulk samples from four homogeneous areas were submitted to the laboratory. Based on the laboratory analysis of the bulk samples collected during the survey, ***none of the materials sampled were reported to contain one percent or greater asbestos-containing materials.***

The executive summary is an integral portion of this report; however, ECS recommends that the report be read in its entirety.

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Appendix II: Site Photographs

Appendix III: Laboratory Report and Chain of Custody

Appendix IV: Certifications/Licenses

1.0 SITE DESCRIPTION

The property consists of a one-story elementary elementary school building located at 695 Independence Blvd. in Missouri City, Fort Bend County, Texas 77489. Based on the information available, the building comprises approximately 79,102 square feet of space and is situated on 9.02 acres of land. The building was reportedly constructed in 1993.

2.0 PURPOSE

The purpose of the Asbestos Containing Materials Survey was to identify asbestos-containing materials (ACMs) that require special handling and/or disposal if disturbed during construction activities. The identification of ACMs requires trained labor, regulated work practices, and special disposal.

Sampling was performed according to the client-specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email.

ECS Southwest is a Texas Department of State Health Services licensed Asbestos Consultant Agency No. 100592. Based on the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and Texas Department of State Health Services (TDSHS) Texas Asbestos Health Protection Rules (TAHPR). A material is considered to be asbestos containing material (ACM) if one sample collected from the homogeneous area is found to contain one percent or greater of asbestos containing material.

Title 25, Part 1, Chapter 296), the Texas Asbestos Health Protection Rules (TAHPR), and 40 CFR 61, Subpart M, the U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP), require an asbestos survey be performed prior to renovation or demolition activities.

29 CFR 1926.1101, the U.S. Occupational Safety and Health Administration (OSHA) Asbestos Standard for the Construction Industry, regulates workplace exposure to asbestos, classifies construction and maintenance activities which could disturb ACM, and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

The US EPA Asbestos Hazard Emergency Response Act (AHERA) requires all public and private school districts to inspect their schools for asbestos-containing building materials and prepare management plans for identified asbestos-containing materials. Personnel performing asbestos activities in schools must also be trained in accordance with both OSHA and US EPA Asbestos Model Accreditation Plan requirements. Prior to renovation or demolition of a facility, building owners must also comply with regulations under the US EPA Asbestos National Emissions Standards for Hazardous Air Pollutants (NESHAP) for asbestos under 40 CFR 61 Subpart M. This non-invasive survey was performed to comply with US EPA AHERA requirements for the identification of ACMs in schools.

3.0 METHODOLOGY

ECS performed the authorized Scope of Services in general accordance with our proposal, standard industry practice(s) and methods specified by regulation(s) for the identification of ACMs.

3.1 Asbestos-Containing Materials

The suspect asbestos sampling was performed by an EPA-accredited asbestos inspector who has met the requirements of Title 40, Part 763, Part III, Subpart E, Appendix C of the Code of Federal Regulations; and is currently licensed by the Texas Department of State Health Services to perform Asbestos sampling. Mr. Quinton Ayers, a EPA accredited and Texas Department of State Health Services Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. This scope is intended to generally meet the requirements of the Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1926.1101 Inspection Protocol.

Samples of suspect ACMs were collected utilizing hand tools and placed into individual, labeled plastic bags. Unique bulk suspect ACM samples were submitted to Southeastern Environmental Microbiology Laboratories in Katy,, Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology. Materials consisting of additional layers were analyzed separately. SEEML is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) and Texas Department of State Health Services (TDSHS) Laboratory license #300474 for bulk sample analysis by currently approved EPA methodology by PLM Method.

During the survey, ECS attempted to identify suspect ACMs in readily accessible areas. However, due to the destructive means required to identify some materials, certain areas were deemed inaccessible (i.e. behind walls or sub grade materials) and were not surveyed for suspect ACMs. Unidentified suspect ACMs may be located in these and/or other inaccessible areas. Additional areas include but are not limited to the exterior and other interior areas of the subject building.

Samples were collected in general accordance with EPA Standard 40 CFR 763 Subpart E, Asbestos Hazard Emergency Response Act (AHERA) and OSHA Standard 29 CFR 1926.1101 Inspection Protocol. Multiple samples of each unique material were submitted. Samples were analyzed using the “Positive Stop” methodology. If one sample of homogeneous material is reported to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis.

4.0 RESULTS

The following is a summary of laboratory results, findings and observations.

4.1 Asbestos Sampling

An Asbestos-Containing Material (ACM) is defined as any material containing more than one percent (>1%) asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, PLM. Materials are categorized by the U.S. EPA in the following categories:

- Friable ACMs are defined as any ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. Non-friable ACMs are defined as any ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- Category I non-friable ACM are listed as following: packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one percent (>1%) asbestos.

- Category II non-friable ACM are listed as any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos.

Regulated Asbestos Containing Materials (RACM) are friable ACM or non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or has crumbled, been pulverized, or reduced to powder in the course of renovation and/or demolition operations.

Based on the laboratory analysis performed by Southeastern Environmental Microbiology Laboratories of the bulk samples collected during the survey on Monday July 28, 2025. ***None of the sampled materials were reported to contain 1% or greater asbestos content and therefore none were found to be asbestos-containing materials.*** The survey addressed the gym renovations only. A complete list of the sampled materials submitted for analysis and the laboratory report are included in Appendix III. A diagram showing sample locations are included in Appendix I of this report. Photographs of representative building materials are located in Appendix II of this report.

4.2 Suspect or Assumed Asbestos-Containing Materials

Due to the inaccessibility or the destructive means that asbestos sampling requires, additional suspect ACMs may remain within the building hidden behind inaccessible areas that include, but are not limited to, sub-grade walls, structural members, topping slabs, sub-grade sealants, flooring located below underlayments, areas behind exterior walls, pipe trenches, and subsurface utilities, etc. These areas were deemed inaccessible and were not assessed.

- Materials and locations outside of the client-specified areas in the gym renovations area.
- Pipe Chases behind and above restrooms and sinks
- Exterior
- Mirror Mastic
- Roof
- Crawlspaces

If these materials are discovered during construction activities, they should be presumed to contain asbestos and be treated as ACMs or be sampled immediately upon discovery and prior to the disturbance for asbestos content by a certified asbestos inspector in accordance with 29 CFR 1926.1101.

5.0 RECOMMENDATIONS AND REGULATORY REQUIREMENTS

Based on our understanding of the purpose of the Asbestos Containing Materials Survey, the results of laboratory analysis, and our findings and observations, ECS presents the following recommendations.

5.1 Asbestos-Containing Materials

Based on the asbestos containing materials survey and laboratory results, None of the bulk samples submitted to Southeastern Environmental Microbiology Laboratories were reported to contain detectable concentrations of asbestos. If additional suspect asbestos-containing materials are

uncovered which were not accessible during this sampling event, it is recommended that these materials be sampled or tested immediately upon discovery for asbestos content by an asbestos inspector in accordance with 29 CFR 1926.1101.

Additional suspect ACMs may remain within inaccessible areas that include but are not limited to, sub-grade walls, structural members, topping slabs, exterior areas, sub-grade sealants, flooring located below underlayments, vapor barriers, pipe trenches, pipe chases and other subsurface utilities, etc. If additional suspect ACMs are uncovered which were not accessible during this survey, it is recommended that these materials either be assumed to contain asbestos or be sampled prior to disturbance upon discovery for asbestos content by an EPA accredited and TDSHS licensed asbestos inspector in accordance with 29 CFR 1926.1101 and Texas Asbestos Health Protection Rules (TAHPR). An Asbestos Abatement Specification is required be prepared to delineate and quantify known and suspect hazardous and regulated materials in the buildings and to outline proper procedures for the abatement. This is a TDSHS requirement prior to demolition or renovation activities which may disturb the identified asbestos containing material in the path of construction. This will help protect the owner's liability in better defining the scope of work and contractors' roles and responsibilities in the abatement process and holding the contractor accountable for the performance of the project. The specification typically defines the Contractor's scope of work and outlines requirements and procedures that must be followed for the project. The intent of the specification is to give performance requirements for the Contractor so that the project can be completed safely and in compliance with applicable federal and state regulations. Typically, the asbestos abatement specification document serves as part of the site owner's contract with the contractor.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

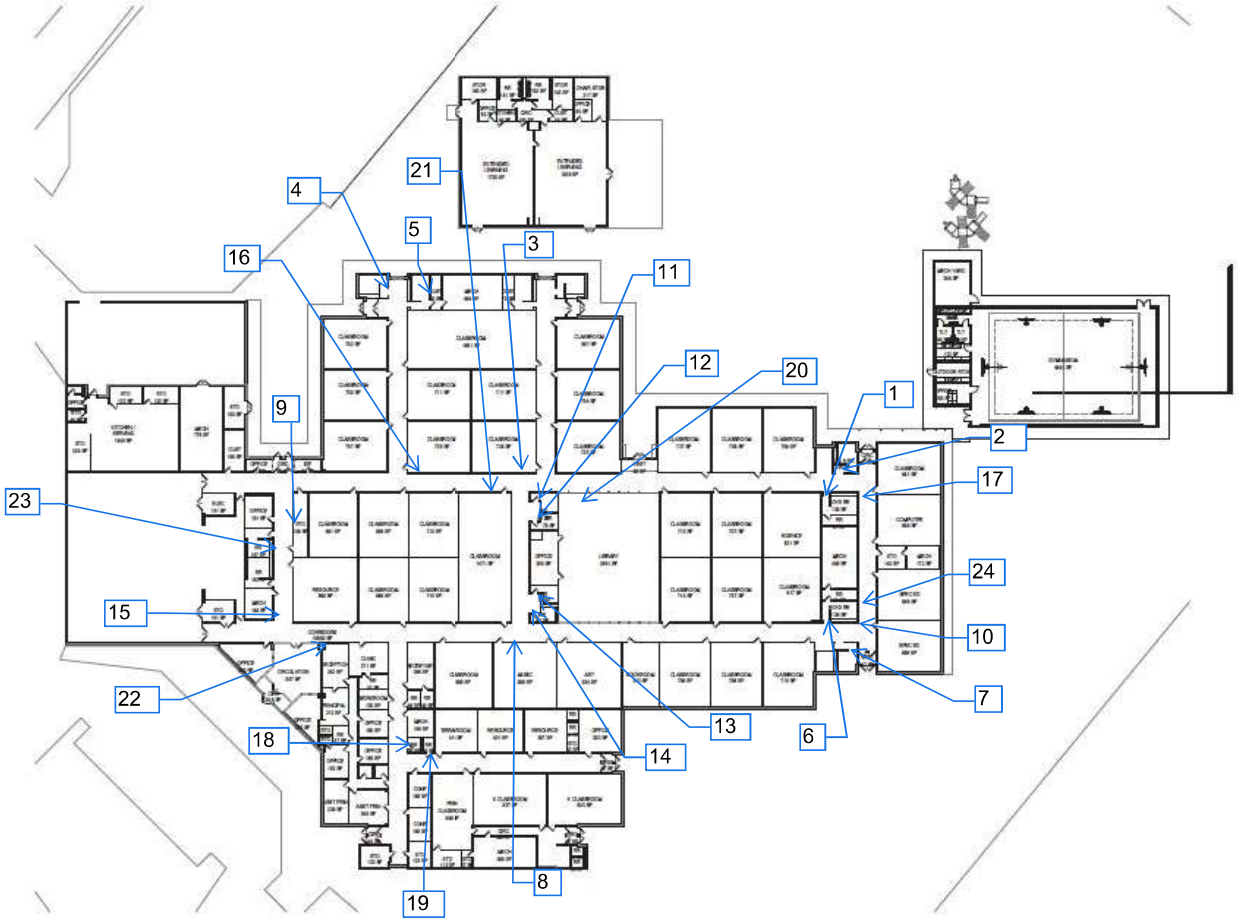
The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

During this study, samples were submitted for analysis at an accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No warranty, expressed or implied, is made.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of

services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

Appendix I: Figures



Legend

- None Detected Sample Location

Note: Locations are Approximate

PROJECT #:	51-5007
DRAWN BY:	QA
ASSIGN TO:	QA
PE:	MJD
DATE:	August 14 2025
REVISED:	----
SCALE:	Approximate

Hunters Glen Elementary School
695 Independence Boulevard
Missouri City, Texas77489

Asbestos Sample Location Drawing

Figure
1

Appendix II: Site Photographs



1 - Typical area above ceiling

Appendix III: Laboratory Report and Chain of Custody

SEEML Reference Number:
G-250731135
Date Issued: 07/31/2025

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
Fax: (864) 233-6589

Asbestos Analytical Report By: Polarized Light Microscopy

This report has been prepared for **ECS Southwest** the information and data has been checked for thoroughness and accuracy. The results reported apply only to the materials as received. The documents(s) contained herein are confidential and privileged information intended for the exclusive use of the individual or entity named above. This report shall not be reproduced except in full without SEEML's approval.

Client Project Name: Hunters Glen ES
The Following report was prepared using this test method(s) contained within this document.

- [x] EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
- [ ] PLM 400 Point Count (<0.25%) EPA 600/R-93/116
- [ ] PLM 1000 Point Count (<0.1%) EPA 600/R-93/116
- [ ] PLM Carb 435 Level A Reporting Limit (<0.25%)
- [ ] PLM Carb 435 Level B (Reporting limit <0.1%)
- [ ] PLM by EPA/600/R-93/116 with Milling Prep 400 Point Count
- [ ] PLM Vermiculite Initial Screening EPA 600R-93/116
- [ ] PLM Cincinnati Method 600/R-04/004 (Amphibole Only)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 1 Chrysotile & Prep)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 2 (Amphibole)

Approved By : *Andrea Berrios*

Thank you for choosing SEEML Labs. We strive to provide superior quality testing, analytical data and customer service. SEEML is accredited through the National Institute of Standards and Technology (NIST) National Voluntary Accreditation Program (NVLAP) for bulk asbestos analysis NVLAP # 201031-0 and licensed by the Texas Department of State Health Services (License Number: 300474). This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Hunters Glen ES
		Project No:	
Analyzed by:	Trent Bucich	Project Address:	695 Independance Blvd
		City, State. ZIP:	Missouri City, Texas 77489
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731135

Client No.: / Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
1 G-250731135-625A	(Off-White) Drywall/Boys SE RR	**None Detected**	10% Cellulose,5% Fiberglass	85% Gypsum
2 G-250731135-626A	(Off-White) Drywall/Girls SE RR	**None Detected**	10% Cellulose,5% Fiberglass	85% Gypsum
3 G-250731135-627A	(Off-White) Drywall/East Hallway	**None Detected**	15% Cellulose	85% Gypsum
4 G-250731135-628A	(Off-White) Drywall/Girls NE RR	**None Detected**	10% Cellulose,5% Fiberglass	85% Gypsum
5 G-250731135-629A	(Off-White) Drywall/Boys NE RR	**None Detected**	15% Cellulose	85% Gypsum
6 G-250731135-630A	(Off-White) Drywall/Boys SW RR	**None Detected**	15% Cellulose	85% Gypsum
7 G-250731135-631A	(Off-White) Drywall/Girls SW RR	**None Detected**	15% Cellulose	85% Gypsum
8 G-250731135-632A	(White) Ceiling Tile/West Hallway	**None Detected**	40% Fiberglass,60% Cellulose	None Detected
9 G-250731135-633A	(White) Ceiling Tile/North Hallway	**None Detected**	40% Fiberglass,60% Cellulose	None Detected

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
Any opinions/interpretations expressed in this report are outside the scope of this laboratory's accreditation. Interpretation of the data and information within this document is left to the company, consultant, and/or persons who conducted the fieldwork. A material is considered regulated asbestos containing material (ACM) where the asbestos content is determined to be one percent or greater. Several organizations, including the American Conference of Government Industrial Hygienists (ACGIH); the American Industrial Hygiene Association (AIHA); the Indoor Air Quality Association (IAQA); the United States Environmental Protection Agency (USEPA); the Centers for Disease Control (CDC) as well as the California Department of Health Services (CADHS) have published guidelines for assessment and interpretation of analytical data indicating a tested material is ACM.

Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Hunters Glen ES
		Project No:	
Analyzed by:	Trent Bucich	Project Address:	695 Independance Blvd
		City, State. ZIP:	Missouri City, Texas 77489
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731135

Client No.: / Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
10 G-250731135-634A	(White) Ceiling Tile/South Hallway	**None Detected**	30% Fiberglass,60% Cellulose	10% Perlite
11 G-250731135-635A	(White) Ceiling Tile/East Central Boys RR	**None Detected**	30% Fiberglass,60% Cellulose	10% Perlite
12 G-250731135-636A	(White) Ceiling Tile/East Central Girls RR	**None Detected**	30% Fiberglass,60% Cellulose	10% Perlite
13 G-250731135-637A	(White) Ceiling Tile/West Central Girls RR	**None Detected**	30% Fiberglass,60% Cellulose	10% Perlite
14 G-250731135-638A	(White) Ceiling Tile/West Central Boys RR	**None Detected**	40% Fiberglass,60% Cellulose	None Detected
15 G-250731135-639A	(Black) Covebase/North Hallway	**None Detected**	None Detected	100% Organic Matrix
15 G-250731135-639B	(Tan) Mastic/North Hallway	**None Detected**	None Detected	100% Organic Matrix
16 G-250731135-640A	(Black) Covebase/East Hallway	**None Detected**	None Detected	100% Organic Matrix
16 G-250731135-640B	(Tan) Mastic/East Hallway	**None Detected**	None Detected	100% Organic Matrix

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

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Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Hunters Glen ES
		Project No:	
Analyzed by:	Trent Bucich	Project Address:	695 Independance Blvd
		City, State. ZIP:	Missouri City, Texas 77489
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731135

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
17 G-250731135-641A	(Black) Covebase/South Hallway	**None Detected**	None Detected	100% Organic Matrix
17 G-250731135-641B	(Tan) Mastic/South Hallway	**None Detected**	None Detected	100% Organic Matrix
18 G-250731135-642A	(Black) Covebase/Girls NW RR	**None Detected**	None Detected	100% Organic Matrix
18 G-250731135-642B	(Tan) Mastic/Girls NW RR	**None Detected**	None Detected	100% Organic Matrix
19 G-250731135-643A	(Black) Covebase/Boys NW RR	**None Detected**	None Detected	100% Organic Matrix
19 G-250731135-643B	(Tan) Mastic/Boys NW RR	**None Detected**	None Detected	100% Organic Matrix
20 G-250731135-644A	(Yellow) Insulation/Libarary	**None Detected**	10% Cellulose,90% Fiberglass	None Detected
21 G-250731135-645A	(Yellow) Insulation/East Hallway	**None Detected**	10% Cellulose,90% Fiberglass	None Detected
22 G-250731135-646A	(Yellow) Insulation/West Hallway	**None Detected**	5% Cellulose,95% Fiberglass	None Detected

Approved By: Andrea Berrios

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NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Hunters Glen ES
		Project No:	
Analyzed by:	Trent Bucich	Project Address:	695 Independance Blvd
		City, State. ZIP:	Missouri City, Texas 77489
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731135

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
23 G-250731135-647A	(Yellow) Insulation/North Hallway	**None Detected**	5% Cellulose,95% Fiberglass	None Detected
24 G-250731135-648A	(Yellow) Insulation/South Hallway	**None Detected**	5% Cellulose,95% Fiberglass	None Detected

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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SEEML Asbestos Chain-of-Custody Form

410 W. Grand Pkwy S. #250, Katy, Texas 77494
Ph: (832) 437-2667
WWW.SEEML.COM
NVLAP Lab ID: 600385-0

SEEML Ref#		Lab ID:	
Company:	ECS Southwest	Date Sample:	7/28/25
Project Manager:	Quinton Ayers	Project Name:	Hunters Glen ES
Address:	1000 N Post Oak Road Suite 240	Project Location:	695 Independance Blvd
City, State, Zip:	Houston, Texas		Missouri City, Texas 77489
Phone:	(202) 993-2583	Project No:	51-5087
Email:	qayers@ecslimited.com		

PLM TAT: RUSH SAME DAY NEXT DAY 2DAY 3 DAY 4 DAY 5 DAY

PLM-Bulk: **Positive Stop** **Yes** X **No** _____

- ☐ PLM EPA Method 600/R-93/116 -Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.
- ☐ PLM NOB (<1%) Gravimetric

Point Count **Positive Stop** **Yes** _____ **No** _____

- ☐ 400 w/o Gravimetric (<0.25%)
- ☐ 1000 w/o Gravimetric (0.1%)
- ☐ 400 with Gravimetric (0.25%)
- ☐ 1000 with Gravimetric (<0.1%)

PCM-AIR

- ☐ NIOSH 7400

SOIL/ROCK/VERMICULITE

- ☐ PLM CARB 435- Level A (400 Point Count <0.25%)
- ☐ PLM CARB 435- Level B (1000 Point Count <0.1%)
- ☐ Cincinnati Method EPA 600/R-04/004 by PLM

TEM: **SAME DAY** **NEXT DAY** **2DAY** **3DAY** **4DAY** **5DAY**

*TEM Analysis is subcontracted. TAT starts after PLM results have been submitted by SEEML, unless otherwise requested.

Sample ID	Description/Location	Analysis Type	Comments

See Attached

Relinquished by:	Time/Date	Received by:	Time/Date
Quinton Ayers	7/30/25		

Asbestos Inspection Form

Inspection Date: 7/28/25	**Project No.:** 51-5007
Project Name: Hunters Glen ES	
Building Address: 695 Independance Blvd, Missouri City, Texas	
Inspector Name: Quinton Ayers	**Lab & TAT:** 5-day

Building Description Notes & Exclusions:

Sample Number	Location & Material	Condition	Quantity
1	Dry wall (wall) system (Boy's SE RR)	Good	
2	" " (Girls SE RR)		
3	" " (East Hallway)		
4	" " (Girl's NE RR)		
5	" " (Boy's NE RR)		
6	" " (Boy's SW RR)		
7	" " (Girl's SW RR)		
8	2x4 white ceiling tile w/ pocks (West Hallway)		
9	" " (North Hallway)		
10	" " (South Hallway)		
11	" " (East central Boy's RR)		
12	" " (East central Girl's RR)		
13	" " (West Central Girl's RR)		
14	" " (West central Boy's RR)		
15	Black Cove Base w/ tan mastic (North Hallway)		
16	" " (East Hallway)		
17	" " (South Hallway)		
18	" " (Girl's NW RR)		

Sample Number	Location & Material	Condition	Quantity
19	Black Cove Base w/ tan mastic (Boys NW RR)	Good	
20	Yellow insulation (Library)		
21	" " (East Hallway)		
22	" " (West Hallway)		
23	" " (North Hallway)		
24	" " (South Hallway)		

Appendix IV: Certifications/ Licenses

Texas Department of State Health Services

ECS SOUTHWEST, LLP

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100592

Expiration Date: 07/05/2026

Control Number: 97672

Jennifer Shuford, MD, MPH,
Commissioner of Health

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

SOUTHEAST ENVIRONMENTAL MICROBIOLOGY LABORATORIES
DBA
SEEML LABS

is certified to perform as an

Asbestos Laboratory

PLM

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 300523

Expiration Date: 02/09/2027

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 96862

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK


TEXAS
Health and Human Services
Texas Department of State Health Services
Asbestos Individual Consultant
MARTIN J DEHLINGER
License Number: 105786
Control Number: 98523
Expiration Date: 15-Feb-2027


Texas Department of State Health Services
Asbestos Inspector
QUINTON DAVIS AYERS
License No. 604172
Control No. 100868
Expiration Date: 14-Apr-2026

ASBESTOS CONTAINING MATERIALS SURVEY

FORT BEND ISD - BOND PACKAGE 022 - GYM RENOVATION
PALMER ELEMENTARY SCHOOL

4208 CROW VALLEY DRIVE
MISSOURI CITY, TEXAS 77459

ECS PROJECT NO. 51:51-5007

FOR: FORT BEND INDEPENDENT SCHOOL DISTRICT

AUGUST 21, 2025

August 21, 2025

Ms. Nancy Lane
Fort Bend Independent School District
555 Julie Rivers Drive
Sugarland, Texas 77478
nancy.lane@fortbendisd.gov

ECS Project No. 51:51-5007

Reference: Asbestos Containing Materials Survey, Palmer Elementary School, 4208 Crow Valley Drive, Missouri City, Texas 77459

Dear Ms. Lane:

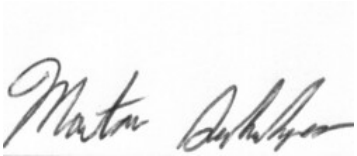
ECS Southwest, LLP (ECS) is pleased to provide Fort Bend Independent School District with the results of the above referenced Asbestos Containing Materials Survey performed at Palmer Elementary School located at 4208 Crow Valley Drive in Missouri City, Texas 77459. This report summarizes our observations, analytical results, findings, and recommendations related to the work performed. The work described in this report was performed by ECS in general accordance with the Scope of Services described in ECS Proposal Number 51:7838 and the terms and conditions of the agreement authorizing those services.

ECS appreciates this opportunity to provide Fort Bend Independent School District with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Southwest, LLP





Quinton Ayers
Environmental Project Manager
QAyers@ECSLimited.com
202-993-2583

Martin Dehlinger
Department Manager, Associate Principal
MDehlinger@ECSLimited.com
832-993-6476

EXECUTIVE SUMMARY

The subject property consists of a one-story elementary school located at 4208 Crow Valley Drive, in Missouri City, Fort Bend County, Texas 77459. The structure consists of 79,294 square feet and was reportedly originally constructed in 1993. At the time of the survey, the subject building was occupied by essential staff during summer break and is currently scheduled to be renovated as part of Bond Package 022 “Gym Renovation”.

The purpose of the survey was to determine if asbestos-containing materials (ACMs) are present within the client specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email. The survey was performed within representative interior areas of the subject building only.

ECS performed its survey of the elementary school on Monday July 28, 2025. Quinton Ayers, a Texas Department of State Health Services (TDSHS) Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. Bulk samples were submitted to Southeastern Environmental Microbiology Laboratories (SEEML) in Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology.

A total of 26 bulk samples from four homogeneous areas were submitted to the laboratory. Based on the laboratory analysis of the bulk samples collected during the survey, ***none of the materials sampled were reported to contain one percent or greater asbestos-containing materials.***

The executive summary is an integral portion of this report; however, ECS recommends that the report be read in its entirety.

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1.0 SITE DESCRIPTION

The property consists of a one-story elementary elementary school building located at 4208 Crow Valley Drive in Missouri City, Fort Bend County, Texas 77459. Based on the information available, the building comprises approximately 79,294 square feet of space and is situated on 9.38 acres of land. The building was reportedly constructed in 1993.

2.0 PURPOSE

The purpose of the Asbestos Containing Materials Survey was to identify asbestos-containing materials (ACMs) that require special handling and/or disposal if disturbed during construction activities. The identification of ACMs requires trained labor, regulated work practices, and special disposal. Sampling was performed according to the client-specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email.

ECS Southwest is a Texas Department of State Health Services licensed Asbestos Consultant Agency No. 100592. Based on the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and Texas Department of State Health Services (TDSHS) Texas Asbestos Health Protection Rules (TAHPR). A material is considered to be asbestos containing material (ACM) if one sample collected from the homogeneous area is found to contain one percent or greater of asbestos containing material.

Title 25, Part 1, Chapter 296), the Texas Asbestos Health Protection Rules (TAHPR), and 40 CFR 61, Subpart M, the U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP), require an asbestos survey be performed prior to renovation or demolition activities.

29 CFR 1926.1101, the U.S. Occupational Safety and Health Administration (OSHA) Asbestos Standard for the Construction Industry, regulates workplace exposure to asbestos, classifies construction and maintenance activities which could disturb ACM, and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

The US EPA Asbestos Hazard Emergency Response Act (AHERA) requires all public and private school districts to inspect their schools for asbestos-containing building materials and prepare management plans for identified asbestos-containing materials. Personnel performing asbestos activities in schools must also be trained in accordance with both OSHA and US EPA Asbestos Model Accreditation Plan requirements. Prior to renovation or demolition of a facility, building owners must also comply with regulations under the US EPA Asbestos National Emissions Standards for Hazardous Air Pollutants (NESHAP) for asbestos under 40 CFR 61 Subpart M. This non-invasive survey was performed to comply with US EPA AHERA requirements for the identification of ACMs in schools.

3.0 METHODOLOGY

ECS performed the authorized Scope of Services in general accordance with our proposal, standard industry practice(s) and methods specified by regulation(s) for the identification of ACMs.

3.1 Asbestos-Containing Materials

The suspect asbestos sampling was performed by an EPA-accredited asbestos inspector who has met the requirements of Title 40, Part 763, Part III, Subpart E, Appendix C of the Code of Federal Regulations; and is currently licensed by the Texas Department of State Health Services to perform Asbestos sampling. Mr. Quinton Ayers, a EPA accredited and Texas Department of State Health Services Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. This scope is intended to generally meet the requirements of the Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1926.1101 Inspection Protocol.

Samples of suspect ACMs were collected utilizing hand tools and placed into individual, labeled plastic bags. Unique bulk suspect ACM samples were submitted to Southeastern Environmental Microbiology Laboratories in Katy,, Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology. Materials consisting of additional layers were analyzed separately. SEEML is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) and Texas Department of State Health Services (TDSHS) Laboratory license #300474 for bulk sample analysis by currently approved EPA methodology by PLM Method.

During the survey, ECS attempted to identify suspect ACMs in readily accessible areas. However, due to the destructive means required to identify some materials, certain areas were deemed inaccessible (i.e. behind walls or sub grade materials) and were not surveyed for suspect ACMs. Unidentified suspect ACMs may be located in these and/or other inaccessible areas. Additional areas include but are not limited to the exterior and other interior areas of the subject building.

Samples were collected in general accordance with EPA Standard 40 CFR 763 Subpart E, Asbestos Hazard Emergency Response Act (AHERA) and OSHA Standard 29 CFR 1926.1101 Inspection Protocol. Multiple samples of each unique material were submitted. Samples were analyzed using the “Positive Stop” methodology. If one sample of homogeneous material is reported to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis.

4.0 RESULTS

The following is a summary of laboratory results, findings and observations.

4.1 Asbestos Sampling

An Asbestos-Containing Material (ACM) is defined as any material containing more than one percent (>1%) asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, PLM. Materials are categorized by the U.S. EPA in the following categories:

- Friable ACMs are defined as any ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. Non-friable ACMs are defined as any ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- Category I non-friable ACM are listed as following: packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one percent (>1%) asbestos.

- Category II non-friable ACM are listed as any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos.

Regulated Asbestos Containing Materials (RACM) are friable ACM or non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or has crumbled, been pulverized, or reduced to powder in the course of renovation and/or demolition operations.

Based on the laboratory analysis performed by Southeastern Environmental Microbiology Laboratories of the bulk samples collected during the survey on Monday July 28, 2025. ***None of the sampled materials were reported to contain 1% or greater asbestos content and therefore none were found to be asbestos-containing materials.*** The survey addressed the gym renovations only. A complete list of the sampled materials submitted for analysis and the laboratory report are included in Appendix III. A diagram showing sample locations are included in Appendix I of this report. Photographs of representative building materials are located in Appendix II of this report.

4.2 Suspect or Assumed Asbestos-Containing Materials

Due to the inaccessibility or the destructive means that asbestos sampling requires, additional suspect ACMs may remain within the building hidden behind inaccessible areas that include, but are not limited to, sub-grade walls, structural members, topping slabs, sub-grade sealants, flooring located below underlayments, areas behind exterior walls, pipe trenches, and subsurface utilities, etc. These areas were deemed inaccessible and were not assessed.

- Materials and locations outside of the client-specified areas in the gym renovations area.
- Pipe Chases behind and above restrooms and sinks
- Exterior
- Mirror Mastic
- Roof
- Crawlspaces

If these materials are discovered during construction activities, they should be presumed to contain asbestos and be treated as ACMs or be sampled immediately upon discovery and prior to the disturbance for asbestos content by a certified asbestos inspector in accordance with 29 CFR 1926.1101.

5.0 RECOMMENDATIONS AND REGULATORY REQUIREMENTS

Based on our understanding of the purpose of the Asbestos Containing Materials Survey, the results of laboratory analysis, and our findings and observations, ECS presents the following recommendations.

5.1 Asbestos-Containing Materials

Based on the asbestos containing materials survey and laboratory results, None of the bulk samples submitted to Southeastern Environmental Microbiology Laboratories were reported to contain detectable concentrations of asbestos. If additional suspect asbestos-containing materials are

uncovered which were not accessible during this sampling event, it is recommended that these materials be sampled or tested immediately upon discovery for asbestos content by an asbestos inspector in accordance with 29 CFR 1926.1101.

Additional suspect ACMs may remain within inaccessible areas that include but are not limited to, sub-grade walls, structural members, topping slabs, exterior areas, sub-grade sealants, flooring located below underlayments, vapor barriers, pipe trenches, pipe chases and other subsurface utilities, etc. If additional suspect ACMs are uncovered which were not accessible during this survey, it is recommended that these materials either be assumed to contain asbestos or be sampled prior to disturbance upon discovery for asbestos content by an EPA accredited and TDSHS licensed asbestos inspector in accordance with 29 CFR 1926.1101 and Texas Asbestos Health Protection Rules (TAHPR). An Asbestos Abatement Specification is required be prepared to delineate and quantify known and suspect hazardous and regulated materials in the buildings and to outline proper procedures for the abatement. This is a TDSHS requirement prior to demolition or renovation activities which may disturb the identified asbestos containing material in the path of construction. This will help protect the owner's liability in better defining the scope of work and contractors' roles and responsibilities in the abatement process and holding the contractor accountable for the performance of the project. The specification typically defines the Contractor's scope of work and outlines requirements and procedures that must be followed for the project. The intent of the specification is to give performance requirements for the Contractor so that the project can be completed safely and in compliance with applicable federal and state regulations. Typically, the asbestos abatement specification document serves as part of the site owner's contract with the contractor.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

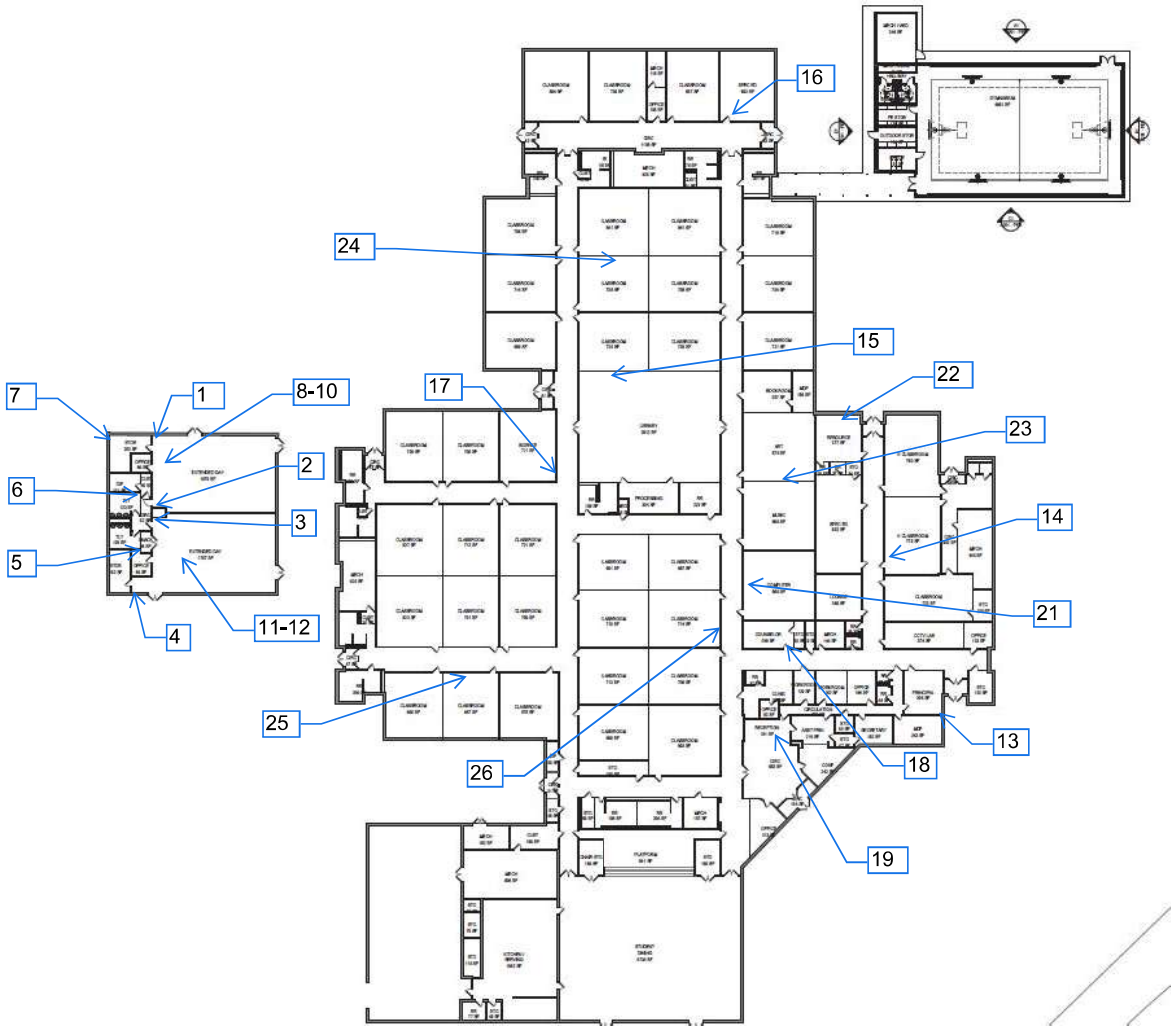
The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

During this study, samples were submitted for analysis at an accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No warranty, expressed or implied, is made.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of

services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

Appendix I: Figures



Legend

- None Detected Sample Location

Note: Locations are Approximate

PROJECT #:	51-5007
DRAWN BY:	QA
ASSIGN TO:	QA
PE:	MJD
DATE:	August 14, 2025
REVISED:	----
SCALE:	Approximate

Palmer Elementary School
4208 Crow Valley Drive
Missouri City, Texas 77459

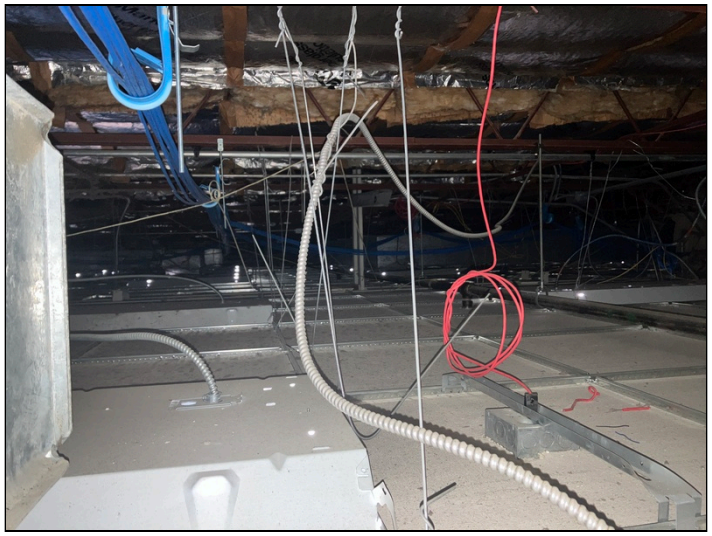
Asbestos Sample Location Drawing

Figure 1

Appendix II: Site Photographs



1 - Extended Day



2 - Typical area above ceiling

Appendix III: Laboratory Report and Chain of Custody

SEEML Reference Number:
G-250731136
Date Issued: 07/31/2025

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
Fax: (864) 233-6589

Asbestos Analytical Report By: Polarized Light Microscopy

This report has been prepared for **ECS Southwest** the information and data has been checked for thoroughness and accuracy. The results reported apply only to the materials as received. The documents(s) contained herein are confidential and privileged information intended for the exclusive use of the individual or entity named above. This report shall not be reproduced except in full without SEEML's approval.

Client Project Name: Palmer ES
The Following report was prepared using this test method(s) contained within this document.

- [x] EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
- [ ] PLM 400 Point Count (<0.25%) EPA 600/R-93/116
- [ ] PLM 1000 Point Count (<0.1%) EPA 600/R-93/116
- [ ] PLM Carb 435 Level A Reporting Limit (<0.25%)
- [ ] PLM Carb 435 Level B (Reporting limit <0.1%)
- [ ] PLM by EPA/600/R-93/116 with Milling Prep 400 Point Count
- [ ] PLM Vermiculite Initial Screening EPA 600R-93/116
- [ ] PLM Cincinnati Method 600/R-04/004 (Amphibole Only)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 1 Chrysotile & Prep)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 2 (Amphibole)

Approved By : *Andrea Berrios*

Thank you for choosing SEEML Labs. We strive to provide superior quality testing, analytical data and customer service. SEEML is accredited through the National Institute of Standards and Technology (NIST) National Voluntary Accreditation Program (NVLAP) for bulk asbestos analysis NVLAP # 201031-0 and licensed by the Texas Department of State Health Services (License Number: 300474). This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Palmer ES
		Project No:	51-5007
Analyzed by:	Melissa Fillion	Project Address:	4208 Crow Valley Drive
		City, State. ZIP:	Missouri City, Texas 77459
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731136

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
1 G-250731136-649A	(Yellow) Insulation/Gym	**None Detected**	97% Fiberglass	3% Organic Matrix
2 G-250731136-650A	(Yellow) Insulation/Gym	**None Detected**	98% Fiberglass	2% Organic Matrix
3 G-250731136-651A	(Yellow) Insulation/Extended Day	**None Detected**	98% Fiberglass	2% Organic Matrix
4 G-250731136-652A	(Yellow) Insulation/Extended Day	**None Detected**	98% Fiberglass	2% Organic Matrix
5 G-250731136-653A	(Yellow) Insulation/Boy's RR	**None Detected**	97% Fiberglass	3% Organic Matrix
6 G-250731136-654A	(White) Drywall/Girls RR	**None Detected**	3% Cellulose,5% Fiberglass	92% Gypsum
7 G-250731136-655A	(White) Drywall/Mech Room	**None Detected**	3% Cellulose,7% Fiberglass	90% Gypsum
8 G-250731136-656A	(White) Drywall/Gym	**None Detected**	10% Fiberglass,2% Cellulose	88% Gypsum
9 G-250731136-657A	(White) Texture/GYm	**None Detected**	None Detected	100% Binder/Filler

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
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102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Palmer ES
		Project No:	51-5007
Analyzed by:	Melissa Fillion	Project Address:	4208 Crow Valley Drive
		City, State. ZIP:	Missouri City, Texas 77459
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731136

Client No.: / Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
9 G-250731136-657B	(White) Drywall/GYm	**None Detected**	10% Fiberglass	90% Gypsum
10 G-250731136-658A	(White) Texture/Gym	**None Detected**	None Detected	100% Binder/Filler
11 G-250731136-659A	(White) Texture/Extended Day	**None Detected**	None Detected	100% Binder/Filler
12 G-250731136-660A	(White) Texture/Extended Day	**None Detected**	None Detected	100% Binder/Filler
12 G-250731136-660B	(White) Drywall/Extended Day	**None Detected**	8% Fiberglass	92% Gypsum
13 G-250731136-661A	(Tan) Mastic/Principal's Office	**None Detected**	None Detected	100% Organic Matrix
14 G-250731136-662A	(Yellow) Mastic/K Room	**None Detected**	None Detected	100% Organic Matrix
15 G-250731136-663A	(Yellow) Mastic/Library	**None Detected**	None Detected	100% Organic Matrix
16 G-250731136-664A	(Tan) Mastic/Special Ed	**None Detected**	None Detected	100% Organic Matrix

Approved By: Andrea Berrios

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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Palmer ES
		Project No:	51-5007
Analyzed by:	Melissa Fillion	Project Address:	4208 Crow Valley Drive
		City, State. ZIP:	Missouri City, Texas 77459
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731136

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
17 G-250731136-665A	(Tan) Mastic/Science Room	**None Detected**	None Detected	100% Organic Matrix
18 G-250731136-666A	(Tan) Mastic/Counselor Room	**None Detected**	None Detected	100% Organic Matrix
19 G-250731136-667A	(Tan) Mastic/Reception	**None Detected**	None Detected	100% Organic Matrix
20 G-250731136-668A	(White) Drywall/Assistant Principal Room	**None Detected**	10% Cellulose,5% Fiberglass	85% Gypsum
21 G-250731136-669A	(White) Drywall/Computer ROom	**None Detected**	10% Cellulose	90% Gypsum
22 G-250731136-670A	(White) Drywall/Resource ROom	**None Detected**	10% Cellulose,2% Fiberglass	88% Gypsum
23 G-250731136-671A	(White) Drywall/Art Room	**None Detected**	2% Fiberglass,8% Cellulose	90% Gypsum
24 G-250731136-672A	(White) Drywall/5th Grade Room	**None Detected**	5% Cellulose	95% Gypsum
25 G-250731136-673A	(White) Drywall/4th Grade Room	**None Detected**	3% Fiberglass,5% Cellulose	92% Gypsum

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
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Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Palmer ES
		Project No:	51-5007
Analyzed by:	Melissa Fillion	Project Address:	4208 Crow Valley Drive
		City, State. ZIP:	Missouri City, Texas 77459
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731136

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
26 G-250731136-674A	(White) Drywall/1st Grade Room	**None Detected**	5% Cellulose	95% Gypsum

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
Any opinions/interpretations expressed in this report are outside the scope of this laboratory's accreditation. Interpretation of the data and information within this document is left to the company, consultant, and/or persons who conducted the fieldwork. A material is considered regulated asbestos containing material (ACM) where the asbestos content is determined to be one percent or greater. Several organizations, including the American Conference of Government Industrial Hygienists (ACGIH); the American Industrial Hygiene Association (AIHA); the Indoor Air Quality Association (IAQA); the United States Environmental Protection Agency (USEPA); the Centers for Disease Control (CDC) as well as the California Department of Health Services (CADHS) have published guidelines for assessment and interpretation of analytical data indicating a tested material is ACM.

SEEML Asbestos Chain-of-Custody Form

410 W. Grand Pkwy S. #250, Katy, Texas 77494
Ph: (832) 437-2667
WWW.SEEML.COM
NVLAP Lab ID: 600385-0

SEEML Ref#		Lab ID:	
Company:	ECS Southwest	Date Sample:	7/28/25
Project Manager:	Quinton Ayers	Project Name:	Palmer ES
Address:	1000 N Post Oak Road Suite 240	Project Location:	4208 Crow Valley Drive,
City, State, Zip:	Houston, Texas		Missouri City, Texas, 77459
Phone:	(202) 993-2583	Project No:	51-5087
Email:	qayers@ecslimited.com		

PLM TAT: RUSH SAME DAY NEXT DAY 2DAY 3 DAY 4 DAY (5 DAY)

PLM-Bulk: **Positive Stop** **Yes** X **No** ____

- ☐ PLM EPA Method 600/R-93/116 -Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.
- ☐ PLM NOB (<1%) Gravimetric

Point Count **Positive Stop** **Yes** _____ **No** _____

- ☐ 400 w/o Gravimetric (<0.25%)
- ☐ 1000 w/o Gravimetric (0.1%)
- ☐ 400 with Gravimetric (0.25%)
- ☐ 1000 with Gravimetric (<0.1%)

PCM-AIR

- ☐ NIOSH 7400

SOIL/ROCK/VERMICULITE

- ☐ PLM CARB 435- Level A (400 Point Count <0.25%)
- ☐ PLM CARB 435- Level B (1000 Point Count <0.1%)
- ☐ Cincinnati Method EPA 600/R-04/004 by PLM

TEM: **SAME DAY** **NEXT DAY** **2DAY** **3DAY** **4DAY** **5DAY**

*TEM Analysis is subcontracted. TAT starts after PLM results have been submitted by SEEML, unless otherwise requested.

Sample ID	Description/Location	Analysis Type	Comments

See Attached

Relinquished by:	Time/Date	Received by:	Time/Date
Quinton Ayers	7/30/25		

Asbestos Inspection Form

Inspection Date: 7/29/25	**Project No.:** 51-5007
Project Name: Palmer ES	
Building Address: 4208 Crow Valley Drive, Missouri City, TX	
Inspector Name: Quinton Ayers	**Lab & TAT:** 5-day

Building Description Notes & Exclusions:

Sample Number	Location & Material	Condition	Quantity
1	Drywall (wall) system (Gym)	Damaged	
2	" "	"	
3	" " (Extended Day)	"	
4	" "	"	
5	" " (Boy's RR)	"	
6	" " (Girls RR)	"	
7	" " (Mech Room)	"	
8	Yellow Insulation Ceiling (Gym)	"	
9	" "	"	
10	" "	"	
11	" " (Extended Day)	"	
12	" "	"	
13	Tan carpet mastic (Principal's office)	Good	
14	" " (K Room)	"	
15	" " (Library)	"	
16	" " (Special Ed)	"	
17	" " (Science Room)	"	
18	" " (Counselor Room)	"	

Sample Number	Location & Material	Condition	Quantity
19	Tan carpet mastic (Reception)	Good	
20	Drywall (wall) system (Assistant Principal Room)		
21	" " (Computer Room)		
22	" " (Resource Room)		
23	" " (Art Room)		
24	" " (5th grade Room)		
25	" " (4th grade Room)		
26	" " (1st grade Room)		

Appendix IV: Certifications/ Licenses

Texas Department of State Health Services

ECS SOUTHWEST, LLP

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100592

Expiration Date: 07/05/2026

Control Number: 97672

Jennifer Shuford, MD, MPH,
Commissioner of Health

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

SOUTHEAST ENVIRONMENTAL MICROBIOLOGY LABORATORIES
DBA
SEEML LABS

is certified to perform as an

Asbestos Laboratory

PLM

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 300523

Expiration Date: 02/09/2027

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 96862

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK


TEXAS
Health and Human Services
Texas Department of State Health Services
Asbestos Individual Consultant
MARTIN J DEHLINGER
License Number: 105786
Control Number: 98523
Expiration Date: 15-Feb-2027


Texas Department of State Health Services
Asbestos Inspector
QUINTON DAVIS AYERS
License No. 604172
Control No. 100868
Expiration Date: 14-Apr-2026

ASBESTOS CONTAINING MATERIALS SURVEY

FORT BEND ISD - BOND PACKAGE 022 - GYM RENOVATION
RIDGEGATE ELEMENTARY SCHOOL

6015 W. RIDGECREEK DRIVE
HOUSTON, TEXAS 77053

ECS PROJECT NO. 51:51-5007

FOR: FORT BEND INDEPENDENT SCHOOL DISTRICT

AUGUST 21, 2025

August 21, 2025

Ms. Nancy Lane
Fort Bend Independent School District
555 Julie Rivers Drive
Sugarland, Texas 77478
nancy.lane@fortbendisd.gov

ECS Project No. 51:51-5007

Reference: Asbestos Containing Materials Survey, Ridgegate Elementary School, 6015 W. Ridgecreek Drive, Houston, Texas 77053

Dear Ms. Lane:

ECS Southwest, LLP (ECS) is pleased to provide Fort Bend Independent School District with the results of the above referenced Asbestos Containing Materials Survey performed at Ridgegate Elementary School located at 6015 W. Ridgecreek Drive in Houston, Texas 77053. This report summarizes our observations, analytical results, findings, and recommendations related to the work performed. The work described in this report was performed by ECS in general accordance with the Scope of Services described in ECS Proposal Number 51:7838 and the terms and conditions of the agreement authorizing those services.

ECS appreciates this opportunity to provide Fort Bend Independent School District with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Southwest, LLP





Quinton Ayers
Environmental Project Manager
QAyers@ECSLimited.com
202-993-2583

Martin Dehlinger
Department Manager, Associate Principal
MDehlinger@ECSLimited.com
832-993-6476

EXECUTIVE SUMMARY

The subject property consists of a one-story elementary school located at 6015 W. Ridgecreek Drive, in Houston, Fort Bend County, Texas 77053. The structure consists of 84,378 square feet and was reportedly originally constructed in 1980. At the time of the survey, the subject building was occupied by essential staff during summer break and is currently scheduled to be renovated as part of Bond Package 022 “Gym Renovation”.

The purpose of the survey was to determine if asbestos-containing materials (ACMs) are present within the client specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email. The survey was performed within representative interior areas of the subject building only.

ECS performed its survey of the elementary school on Monday July 28, 2025. Quinton Ayers, a Texas Department of State Health Services (TDSHS) Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. Bulk samples were submitted to Southeastern Environmental Microbiology Laboratories (SEEML) in Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology.

A total of 44 bulk samples from eight homogeneous areas were submitted to the laboratory. Based on the laboratory analysis of the bulk samples collected during the survey, ***none of the materials sampled were reported to contain one percent or greater asbestos-containing materials.***

The executive summary is an integral portion of this report; however, ECS recommends that the report be read in its entirety.

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1.0 SITE DESCRIPTION

The property consists of a one-story elementary elementary school building located at 6015 W. Ridgecreek Drive in Houston, Fort Bend County, Texas 77053. Based on the information available, the building comprises approximately 84,378 square feet of space and is situated on 4.46 acres of land. The building was reportedly constructed in 1980.

2.0 PURPOSE

The purpose of the Asbestos Containing Materials Survey was to identify asbestos-containing materials (ACMs) that require special handling and/or disposal if disturbed during construction activities. The identification of ACMs requires trained labor, regulated work practices, and special disposal. Sampling was performed according to the client-specified areas while on-site and marked-up floor plans provided by Fort Bend Independent School District on May 8, 2025 by email.

ECS Southwest is a Texas Department of State Health Services licensed Asbestos Consultant Agency No. 100592. Based on the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and Texas Department of State Health Services (TDSHS) Texas Asbestos Health Protection Rules (TAHPR). A material is considered to be asbestos containing material (ACM) if one sample collected from the homogeneous area is found to contain one percent or greater of asbestos containing material.

Title 25, Part 1, Chapter 296), the Texas Asbestos Health Protection Rules (TAHPR), and 40 CFR 61, Subpart M, the U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP), require an asbestos survey be performed prior to renovation or demolition activities.

29 CFR 1926.1101, the U.S. Occupational Safety and Health Administration (OSHA) Asbestos Standard for the Construction Industry, regulates workplace exposure to asbestos, classifies construction and maintenance activities which could disturb ACM, and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

The US EPA Asbestos Hazard Emergency Response Act (AHERA) requires all public and private school districts to inspect their schools for asbestos-containing building materials and prepare management plans for identified asbestos-containing materials. Personnel performing asbestos activities in schools must also be trained in accordance with both OSHA and US EPA Asbestos Model Accreditation Plan requirements. Prior to renovation or demolition of a facility, building owners must also comply with regulations under the US EPA Asbestos National Emissions Standards for Hazardous Air Pollutants (NESHAP) for asbestos under 40 CFR 61 Subpart M. This non-invasive survey was performed to comply with US EPA AHERA requirements for the identification of ACMs in schools.

3.0 METHODOLOGY

ECS performed the authorized Scope of Services in general accordance with our proposal, standard industry practice(s) and methods specified by regulation(s) for the identification of ACMs.

3.1 Asbestos-Containing Materials

The suspect asbestos sampling was performed by an EPA-accredited asbestos inspector who has met the requirements of Title 40, Part 763, Part III, Subpart E, Appendix C of the Code of Federal Regulations; and is currently licensed by the Texas Department of State Health Services to perform Asbestos sampling. Mr. Quinton Ayers, a EPA accredited and Texas Department of State Health Services Asbestos Inspector License No. 604172 performed the survey on Monday July 28, 2025. This scope is intended to generally meet the requirements of the Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1926.1101 Inspection Protocol.

Samples of suspect ACMs were collected utilizing hand tools and placed into individual, labeled plastic bags. Unique bulk suspect ACM samples were submitted to Southeastern Environmental Microbiology Laboratories in Katy,, Texas for analysis via Polarized Light Microscopy (PLM) in accordance with the current EPA-600 methodology. Materials consisting of additional layers were analyzed separately. SEEML is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) and Texas Department of State Health Services (TDSHS) Laboratory license #300474 for bulk sample analysis by currently approved EPA methodology by PLM Method.

During the survey, ECS attempted to identify suspect ACMs in readily accessible areas. However, due to the destructive means required to identify some materials, certain areas were deemed inaccessible (i.e. behind walls or sub grade materials) and were not surveyed for suspect ACMs. Unidentified suspect ACMs may be located in these and/or other inaccessible areas. Additional areas include but are not limited to the exterior and other interior areas of the subject building.

Samples were collected in general accordance with EPA Standard 40 CFR 763 Subpart E, Asbestos Hazard Emergency Response Act (AHERA) and OSHA Standard 29 CFR 1926.1101 Inspection Protocol. Multiple samples of each unique material were submitted. Samples were analyzed using the “Positive Stop” methodology. If one sample of homogeneous material is reported to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis.

4.0 RESULTS

The following is a summary of laboratory results, findings and observations.

4.1 Asbestos Sampling

An Asbestos-Containing Material (ACM) is defined as any material containing more than one percent (>1%) asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, PLM. Materials are categorized by the U.S. EPA in the following categories:

- Friable ACMs are defined as any ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. Non-friable ACMs are defined as any ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- Category I non-friable ACM are listed as following: packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one percent (>1%) asbestos.

- Category II non-friable ACM are listed as any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos.

Regulated Asbestos Containing Materials (RACM) are friable ACM or non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or has crumbled, been pulverized, or reduced to powder in the course of renovation and/or demolition operations.

Based on the laboratory analysis performed by Southeastern Environmental Microbiology Laboratories of the bulk samples collected during the survey on Monday July 28, 2025. ***None of the sampled materials were reported to contain 1% or greater asbestos content and therefore none were found to be asbestos-containing materials.*** The survey addressed the gym renovations only. A complete list of the sampled materials submitted for analysis and the laboratory report are included in Appendix III. A diagram showing sample locations are included in Appendix I of this report. Photographs of representative building materials are located in Appendix II of this report.

4.2 Suspect or Assumed Asbestos-Containing Materials

Due to the inaccessibility or the destructive means that asbestos sampling requires, additional suspect ACMs may remain within the building hidden behind inaccessible areas that include, but are not limited to, sub-grade walls, structural members, topping slabs, sub-grade sealants, flooring located below underlayments, areas behind exterior walls, pipe trenches, and subsurface utilities, etc. These areas were deemed inaccessible and were not assessed.

- Materials and locations outside of the client-specified areas in the gym renovations area.
- Pipe Chases behind and above restrooms and sinks
- Exterior
- Mirror Mastic
- Roof
- Crawlspaces

If these materials are discovered during construction activities, they should be presumed to contain asbestos and be treated as ACMs or be sampled immediately upon discovery and prior to the disturbance for asbestos content by a certified asbestos inspector in accordance with 29 CFR 1926.1101.

5.0 RECOMMENDATIONS AND REGULATORY REQUIREMENTS

Based on our understanding of the purpose of the Asbestos Containing Materials Survey, the results of laboratory analysis, and our findings and observations, ECS presents the following recommendations.

5.1 Asbestos-Containing Materials

Based on the asbestos containing materials survey and laboratory results, None of the bulk samples submitted to Southeastern Environmental Microbiology Laboratories were reported to contain detectable concentrations of asbestos. If additional suspect asbestos-containing materials are

uncovered which were not accessible during this sampling event, it is recommended that these materials be sampled or tested immediately upon discovery for asbestos content by an asbestos inspector in accordance with 29 CFR 1926.1101.

Additional suspect ACMs may remain within inaccessible areas that include but are not limited to, sub-grade walls, structural members, topping slabs, exterior areas, sub-grade sealants, flooring located below underlayments, vapor barriers, pipe trenches, pipe chases and other subsurface utilities, etc. If additional suspect ACMs are uncovered which were not accessible during this survey, it is recommended that these materials either be assumed to contain asbestos or be sampled prior to disturbance upon discovery for asbestos content by an EPA accredited and TDSHS licensed asbestos inspector in accordance with 29 CFR 1926.1101 and Texas Asbestos Health Protection Rules (TAHPR). An Asbestos Abatement Specification is required be prepared to delineate and quantify known and suspect hazardous and regulated materials in the buildings and to outline proper procedures for the abatement. This is a TDSHS requirement prior to demolition or renovation activities which may disturb the identified asbestos containing material in the path of construction. This will help protect the owner's liability in better defining the scope of work and contractors' roles and responsibilities in the abatement process and holding the contractor accountable for the performance of the project. The specification typically defines the Contractor's scope of work and outlines requirements and procedures that must be followed for the project. The intent of the specification is to give performance requirements for the Contractor so that the project can be completed safely and in compliance with applicable federal and state regulations. Typically, the asbestos abatement specification document serves as part of the site owner's contract with the contractor.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

During this study, samples were submitted for analysis at an accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No warranty, expressed or implied, is made.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of

services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

Appendix I: Figures



Legend

- None Detected Sample Location

Note: Locations are Approximate

PROJECT #:	51-5007
DRAWN BY:	QA
ASSIGN TO:	QA
PE:	MJD
DATE:	August 14, 2025
REVISED:	----
SCALE:	Approximate

Ridgegate Elementary School
6015 Ridgecreek Drive
Houston, Texas 77053

Asbestos Sample Location Drawing

Figure
1

Appendix II: Site Photographs



1 - Pipes in ceiling



2 - Typical area above ceiling



3 - Gym



4 - Gym office



5 - Gym storage

Appendix III: Laboratory Report and Chain of Custody

SEEML Reference Number:
G-250731130
Date Issued: 07/31/2025

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
Fax: (864) 233-6589

Asbestos Analytical Report By: Polarized Light Microscopy

This report has been prepared for **ECS Southwest** the information and data has been checked for thoroughness and accuracy. The results reported apply only to the materials as received. The documents(s) contained herein are confidential and privileged information intended for the exclusive use of the individual or entity named above. This report shall not be reproduced except in full without SEEML's approval.

Client Project Name: Ridgegate ES
The Following report was prepared using this test method(s) contained within this document.

- [x] EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
- [ ] PLM 400 Point Count (<0.25%) EPA 600/R-93/116
- [ ] PLM 1000 Point Count (<0.1%) EPA 600/R-93/116
- [ ] PLM Carb 435 Level A Reporting Limit (<0.25%)
- [ ] PLM Carb 435 Level B (Reporting limit <0.1%)
- [ ] PLM by EPA/600/R-93/116 with Milling Prep 400 Point Count
- [ ] PLM Vermiculite Initial Screening EPA 600R-93/116
- [ ] PLM Cincinnati Method 600/R-04/004 (Amphibole Only)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 1 Chrysotile & Prep)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 2 (Amphibole)

Approved By : *Andrea Berrios*

Thank you for choosing SEEML Labs. We strive to provide superior quality testing, analytical data and customer service. SEEML is accredited through the National Institute of Standards and Technology (NIST) National Voluntary Accreditation Program (NVLAP) for bulk asbestos analysis NVLAP # 201031-0 and licensed by the Texas Department of State Health Services (License Number: 300474). This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
1 G-250731130-570A	(Tan) Ceiling Tile/Gym	**None Detected**	10% Fiberglass,25% Min Wool,45% Cellulose	20% Perlite
2 G-250731130-571A	(Tan) Ceiling Tile/Extended Day	**None Detected**	10% Fiberglass,30% Min Wool,40% Cellulose	20% Perlite
3 G-250731130-572A	(Tan) Ceiling Tile/Resources Room	**None Detected**	10% Fiberglass,25% Min Wool,45% Cellulose	20% Perlite
4 G-250731130-573A	(Tan) Ceiling Tile/Room 220	**None Detected**	10% Fiberglass,25% Min Wool,40% Cellulose	25% Perlite
5 G-250731130-574A	(Tan) Ceiling Tile/Library	**None Detected**	10% Fiberglass,25% Min Wool,45% Cellulose	20% Perlite
6 G-250731130-575A	(Tan) Ceiling Tile/Art Room	**None Detected**	30% Min Wool,45% Cellulose,5% Fiberglass	20% Perlite
7 G-250731130-576A	(Tan) Ceiling Tile/Mustic Room	**None Detected**	10% Fiberglass,25% Min Wool,45% Cellulose	20% Perlite
8 G-250731130-577A	(White) Joint Compound with White Paint/Gym Storage	**None Detected**	None Detected	100% Binder/Filler
8 G-250731130-577B	(White) Joint Compound-2nd Layer/Gym Storage	**None Detected**	None Detected	100% Binder/Filler

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
Any opinions/interpretations expressed in this report are outside the scope of this laboratory's accreditation. Interpretation of the data and information within this document is left to the company, consultant, and/or persons who conducted the fieldwork. A material is considered regulated asbestos containing material (ACM) where the asbestos content is determined to be one percent or greater. Several organizations, including the American Conference of Government Industrial Hygienists (ACGIH); the American Industrial Hygiene Association (AIHA); the Indoor Air Quality Association (IAQA); the United States Environmental Protection Agency (USEPA); the Centers for Disease Control (CDC) as well as the California Department of Health Services (CADHS) have published guidelines for assessment and interpretation of analytical data indicating a tested material is ACM.

Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
8 G-250731130-577C	(Pink) Drywall/Gym Storage	**None Detected**	70% Cellulose	30% Gypsum
9 G-250731130-578A	(White) Joint Compound with White Paint/GymS torage	**None Detected**	None Detected	100% Binder/Filler
9 G-250731130-578B	(White) Joint Compound/GymS torage	**None Detected**	None Detected	100% Binder/Filler
9 G-250731130-578C	(Pink) Drywall/GymS torage	**None Detected**	65% Cellulose	35% Gypsum
10 G-250731130-579A	(White) Joint Compound with White Paint/Gym Storage	**None Detected**	None Detected	100% Binder/Filler
10 G-250731130-579B	(White) Joint Compound/Gym Storage	**None Detected**	None Detected	100% Binder/Filler
10 G-250731130-579C	(Pink) Drywall/Gym Storage	**None Detected**	25% Cellulose	75% Gypsum
11 G-250731130-580A	(White) Joint Compound with White Paint/Library	**None Detected**	None Detected	100% Binder/Filler
11 G-250731130-580B	(White) Joint Compound/Library	**None Detected**	None Detected	100% Binder/Filler

Approved By: Andrea Berrios

Disclaimer:
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NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
11 G-250731130-580C	(Pink) Drywall/Library	**None Detected**	30% Cellulose	70% Gypsum
12 G-250731130-581A	(White) Joint Compound with White Paint/Library	**None Detected**	None Detected	100% Binder/Filler
12 G-250731130-581B	(White) Joint Compound (NO DW)/Library	**None Detected**	None Detected	100% Binder/Filler
13 G-250731130-582A	(White) Joint Compound/Gym Officw	**None Detected**	None Detected	100% Binder/Filler
13 G-250731130-582B	(Pink) Drywall/Gym Officw	**None Detected**	25% Cellulose	75% Gypsum
14 G-250731130-583A	(White) Joint Compound/K Classroom	**None Detected**	None Detected	100% Binder/Filler
14 G-250731130-583B	(Pink) Drywall/K Classroom	**None Detected**	25% Cellulose	75% Gypsum
15 G-250731130-584A	(White) Joint Compound/Room 220	**None Detected**	None Detected	100% Binder/Filler
15 G-250731130-584B	(Pink) Drywall/Room 220	**None Detected**	30% Cellulose	70% Gypsum

Approved By: Andrea Berrios

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PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
16 G-250731130-585A	(White) Joint Compound/Art	**None Detected**	None Detected	100% Binder/Filler
16 G-250731130-585B	(Pink) Drywall/Art	**None Detected**	20% Cellulose,5% Fiberglass	75% Gypsum
17 G-250731130-586A	(White) Joint Compound/Science	**None Detected**	None Detected	100% Binder/Filler
17 G-250731130-586B	(Pink) Drywall/Science	**None Detected**	30% Cellulose,5% Fiberglass	65% Gypsum
18 G-250731130-587A	(White) Drywall (NO JC)/NE Classroom	**None Detected**	10% Fiberglass,20% Cellulose	70% Gypsum
19 G-250731130-588A	(White) Joint Compound/K Classroom	**None Detected**	None Detected	100% Binder/Filler
19 G-250731130-588B	(Pink) Drywall/K Classroom	**None Detected**	30% Cellulose,5% Fiberglass	65% Gypsum
20 G-250731130-589A	(Yellow) Insulation/Gym Office	**None Detected**	100% Min Wool	None Detected
20 G-250731130-589B	(Brown) Insulation Paper with Foil/Gym Office	**None Detected**	80% Cellulose	20% Organic Matrix

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NVLAP Lab ID:201031-0

PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
21 G-250731130-590A	(Yellow) Insulation/Room 220	**None Detected**	100% Min Wool	None Detected
21 G-250731130-590B	(Brown) Insulation Paper with Foil/Room 220	**None Detected**	85% Cellulose	15% Organic Matrix
22 G-250731130-591A	(Yellow) Insulation/K Classroom	**None Detected**	100% Min Wool	None Detected
22 G-250731130-591B	(Brown) Insulation Paper with Foil/K Classroom	**None Detected**	85% Cellulose	15% Organic Matrix
23 G-250731130-592A	(Yellow) Insulation/NE Classroom	**None Detected**	100% Min Wool	None Detected
23 G-250731130-592B	(Brown) Insulation Paper with Foil/NE Classroom	**None Detected**	80% Cellulose	20% Organic Matrix
24 G-250731130-593A	(Yellow) Insulation/Art Room	**None Detected**	100% Min Wool	None Detected
24 G-250731130-593B	(Brown) Insulation Paper with Foil/Art Room	**None Detected**	85% Cellulose	15% Organic Matrix
25 G-250731130-594A	(Yellow) Insulation/Science Room	**None Detected**	100% Min Wool	None Detected

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PLM Asbestos Bulk Sample Summary

ECS Southwest 100 Post OakRoad #240 Houston, TX, 77055 (281)814-2502		Date Sampled:	07/28/2025
		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
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		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
25 G-250731130-594B	(Brown) Insulation Paper with Foil/Science Room	**None Detected**	85% Cellulose	15% Organic Matrix
26 G-250731130-595A	(Yellow) Insulation/Gym	**None Detected**	100% Min Wool	None Detected
26 G-250731130-595B	(Brown) Insulation Paper with Foil/Gym	**None Detected**	85% Cellulose	15% Organic Matrix
27 G-250731130-596A	(Pink) Insulation/Gym Office	**None Detected**	20% Fiberglass,80% Min Wool	None Detected
28 G-250731130-597A	(Pink) Insulation/Gym Office	**None Detected**	15% Fiberglass,85% Min Wool	None Detected
29 G-250731130-598A	(Pink) Insulation/Room 220	**None Detected**	15% Fiberglass,85% Min Wool	None Detected
30 G-250731130-599A	(Pink) Insulation/Room 220	**None Detected**	15% Fiberglass,85% Min Wool	None Detected
31 G-250731130-600A	(Pink) Insulation/NE Classroom	**None Detected**	15% Fiberglass,85% Min Wool	None Detected
32 G-250731130-601A	(Yellow) Insulation/Gym Office	**None Detected**	25% Fiberglass,75% Min Wool	None Detected

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		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
32 G-250731130-601B	(Off-White) Insulation Paper with Foil/Gym Office	**None Detected**	80% Cellulose	20% Organic Matrix
33 G-250731130-602A	(Yellow) Insulation/Gym Office	**None Detected**	35% Fiberglass,65% Min Wool	None Detected
33 G-250731130-602B	(Off-White) Insulation Paper with Foil/Gym Office	**None Detected**	80% Cellulose	20% Organic Matrix
34 G-250731130-603A	(Yellow) Insulation/Gym Office	**None Detected**	35% Fiberglass,65% Min Wool	None Detected
34 G-250731130-603B	(Off-White) Insulation Paper with Foil/Gym Office	**None Detected**	80% Cellulose	20% Organic Matrix
35 G-250731130-604A	(Gray) Mastic/Main Mech Room	**None Detected**	None Detected	100% Organic Matrix
36 G-250731130-605A	(Gray) Mastic/Main Mech Room	**None Detected**	None Detected	100% Organic Matrix
37 G-250731130-606A	(Gray) Mastic/Main Mech Room	**None Detected**	None Detected	100% Organic Matrix
38 G-250731130-607A	(Yellow) Insulation/Room 220	**None Detected**	100% Min Wool	None Detected

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		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
38 G-250731130-607B	(Brown) Insulation Paper with Tar/Room 220	**None Detected**	85% Cellulose	15% Organic Matrix
39 G-250731130-608A	(Yellow) Insulation/Room 220	**None Detected**	100% Min Wool	None Detected
39 G-250731130-608B	(Brown) Insulation Paper with Tar/Room 220	**None Detected**	85% Cellulose	15% Organic Matrix
40 G-250731130-609A	(Yellow) Insulation/K Classroom	**None Detected**	100% Min Wool	None Detected
40 G-250731130-609B	(Brown) Insulation Paper with Tar/K Classroom	**None Detected**	80% Cellulose	20% Organic Matrix
41 G-250731130-610A	(Yellow) Insulation/K Classroom	**None Detected**	100% Min Wool	None Detected
41 G-250731130-610B	(Brown) Insulation Paper with Tar/K Classroom	**None Detected**	80% Cellulose	20% Organic Matrix
42 G-250731130-611A	(Yellow) Insulation/K Classroom	**None Detected**	100% Min Wool	None Detected
42 G-250731130-611B	(Brown) Insulation Paper with Tar/K Classroom	**None Detected**	85% Cellulose	15% Organic Matrix

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PLM Asbestos Bulk Sample Summary

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		Date Received:	07/31/2025
		Date Analyzed:	07/31/2025
		Date Reported:	07/31/2025
		Date Revised:	
		Project Name:	Ridgegate ES
		Project No:	51-5007
Analyzed by:	Andrea Berrios	Project Address:	6015 Ridgecreek Drive
		City, State. ZIP:	Houston, Texas 77053
Method:	EPA 600/R-93/116- Method for the Determination of Asbestos in Bulk Building Materials - - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples	SEEML Ref#:	G-250731130

Client No.: Lab No:	Description/Location	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material
43 G-250731130-612A	(Yellow) Insulation/NE Classroom	**None Detected**	100% Min Wool	None Detected
43 G-250731130-612B	(Brown) Insulation Paper with Tar/NE Classroom	**None Detected**	85% Cellulose	15% Organic Matrix
44 G-250731130-613A	(Yellow) Insulation/NE Classroom	**None Detected**	100% Min Wool	None Detected
44 G-250731130-613B	(Brown) Insulation Paper with Tar/NE Classroom	**None Detected**	85% Cellulose	15% Organic Matrix

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SEEML Asbestos Chain-of-Custody Form

410 W. Grand Pkwy S. #250, Katy, Texas 77494
Ph: (832) 437-2667
WWW.SEEML.COM
NVLAP Lab ID: 600385-0

SEEML Ref#		Lab ID:	
Company:	ECS Southwest	Date Sample:	7/28/25
Project Manager:	Quinton Ayers	Project Name:	Ridgegate ES
Address:	1000 N Post Oak Road Suite 240	Project Location:	6015 Ridgecreek Drive
City, State, Zip:	Houston, Texas		Houston, Texas 77053
Phone:	(202) 993-2583	Project No:	51-5087
Email:	qayers@ecslimited.com		

PLM TAT: RUSH SAME DAY NEXT DAY 2DAY 3 DAY 4 DAY (5 DAY)

PLM-Bulk: **Positive Stop** **Yes** X **No** ____

- ☐ PLM EPA Method 600/R-93/116 -Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.
- ☐ PLM NOB (<1%) Gravimetric

Point Count **Positive Stop** **Yes** _____ **No** _____

- ☐ 400 w/o Gravimetric (<0.25%)
- ☐ 1000 w/o Gravimetric (0.1%)
- ☐ 400 with Gravimetric (0.25%)
- ☐ 1000 with Gravimetric (<0.1%)

PCM-AIR

- ☐ NIOSH 7400

SOIL/ROCK/VERMICULITE

- ☐ PLM CARB 435- Level A (400 Point Count <0.25%)
- ☐ PLM CARB 435- Level B (1000 Point Count <0.1%)
- ☐ Cincinnati Method EPA 600/R-04/004 by PLM

TEM: **SAME DAY** **NEXT DAY** **2DAY** **3DAY** **4DAY** **5DAY**

*TEM Analysis is subcontracted. TAT starts after PLM results have been submitted by SEEML, unless otherwise requested.

Sample ID	Description/Location	Analysis Type	Comments

See Attached

Relinquished by:	Time/Date	Received by:	Time/Date
Quinton Ayers	7/30/25		

Asbestos Inspection Form

Inspection Date: 7/28/25	**Project No.:** 51-5007
Project Name: Ridgegate ES	
Building Address: 6015 Ridgecrock Drive, Houston, Texas 77053	
Inspector Name: Quinton Ayers	**Lab & TAT:** 5-day

Building Description Notes & Exclusions:

Sample Number	Location & Material	Condition	Quantity
1	2x2 white ceiling tiles w/ packs (Gym)	Good	
2	" (Extended Day)		
3	" (Resources Room)		
4	" (Room 220)		
5	" (Library)		
6	" (Art Room)		
7	" (Mustic Room)		
8	Drywall ceiling w/ joint compound (Gym storage)		
9	"		
10	"		
11	" (Library)		
12	"		
13	Drywall (wall) w/ joint compound (Gym office)		
14	" (K Classroom)		
15	" (Room 220)		
16	" (Art)		
17	" (Science)		
18	" (NE Classroom)		

Sample Number	Location & Material	Condition	Quantity
19	Drywall (wall) w/ joint compound (K Classroom)	Good	
20	Yellow Ceiling insulation (Gym office)		
21	" " (Room 220)		
22	" " (K Classroom)		
23	" " (NE Classroom)		
24	" " (Art Room)		
25	" " (Science Room)		
26	" " (Gym)		
27	HVAC Insulation (Gym office)		
28	" "		
29	" " (Room 220)		
30	" "		
31	" " (NE Classroom)		
32	White Pipe Insulation (Gym office)		
33	" "		
34	" "		
35	Gray HVAC Mastic (Main Mech Room)		
36	" "		
37	" "		
38	Yellow wall Insulation (Room 220)		
39	" "		
40	" " (K Classroom)		
41	" "		
42	" "		
43	" (NE Classroom)		
44	" "		

Appendix IV: Certifications/ Licenses

Texas Department of State Health Services

ECS SOUTHWEST, LLP

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100592

Expiration Date: 07/05/2026

Control Number: 97672

Jennifer Shuford, MD, MPH,
Commissioner of Health

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

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Texas Department of State Health Services

SOUTHEAST ENVIRONMENTAL MICROBIOLOGY LABORATORIES
DBA
SEEML LABS

is certified to perform as an

Asbestos Laboratory

PLM

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 300523

Expiration Date: 02/09/2027

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 96862

(Void After Expiration Date)

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TEXAS
Health and Human Services
Texas Department of State Health Services
Asbestos Individual Consultant
MARTIN J DEHLINGER
License Number: 105786
Control Number: 98523
Expiration Date: 15-Feb-2027


Texas Department of State Health Services
Asbestos Inspector
QUINTON DAVIS AYERS
License No. 604172
Control No. 100868
Expiration Date: 14-Apr-2026

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
HUNTERS GLEN ELEMENTARY SCHOOL
695 INDEPENDENCE BOULEVARD
MISSOURI CITY, TEXAS

Prepared for:
Fort Bend Independent School District
Missouri City, Texas

by

Aviles Engineering Corporation
5790 Windfern
Houston, Texas 77041
713-895-7645

REPORT NO. G103-25A (Final Revision 1)

August 2025

AVILES
ENGINEERING CORP.

August 14, 2025

Ms. Nancy Lane
Fort Bend Independent School District
2323 Texas Parkway
Missouri City, Texas 77489

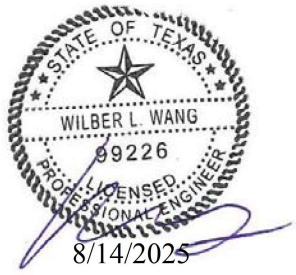
Reference: **Geotechnical Investigation**
Fort Bend Independent School District
BP022 - Gym Renovations and Additions
Hunters Glen Elementary School
695 Independence Boulevard
Missouri City, Texas
AEC Report No.: G103-25A (Final Revision 1)

Dear Ms. Lane,

Aviles Engineering Corporation (AEC) is pleased to present this report of the results of our geotechnical investigation for the above referenced project. The project terms and conditions were performed in accordance with the Master Agreement for Professional Services between Fort Bend Independent School District (FBISD) and AEC, dated August 21, 2023. The project scope of services is in accordance with AEC Proposal No. G2024-12-01R1, dated January 10, 2025.

AEC appreciates the opportunity to be of service to you. Please call us if you have any questions or comments concerning this report or when we can be of further assistance.

Respectfully submitted,
Aviles Engineering Corporation
(TBPELS Firm Registration No. F-42)



Wilber L. Wang, P.E.
Senior Engineer

8/14/2025

Athira Nair, EIT
Staff Engineer

Reports Submitted: 1 Fort Bend Independent School District (electronic)
1 File (electronic)

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
HUNTERS GLEN ELEMENTARY SCHOOL
695 INDEPENDENCE BOULEVARD
MISSOURI CITY, TEXAS

1.0 INTRODUCTION

The contents of this revised report (G103-25A Final Revision 1) prepared by Aviles Engineering Corporation (AEC) supersedes the report previously issued by AEC, dated July 18, 2025 (G103-25A Final).

1.1 General

The report submitted herein presents the results of AEC's geotechnical investigation for the Hunters Glen Elementary School Gymnasium Renovations and Additions project, located at 695 Independence Boulevard, in Missouri City, Texas, as part of the Fort Bend Independent School District (FBISD) 2023 Bond Program (FBISD Project No. BP022). A vicinity map of the project location is presented on Plate A-1, in Appendix A. AEC notes that the overall scope of the FBISD 2023 Bond Program (BP022) includes gym renovations and additions at three elementary schools: Hunter Glen Elementary School, Palmer Elementary School, and Rosa Parks Elementary School. This report, AEC Report No. G103-25A, presents recommendations for Hunters Glen Elementary School only. Recommendations for the remaining elementary schools are presented in AEC Reports G103-25B and G103-25C, respectively.

1.2 Purpose and Scope

Based on the 50 percent CD Submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a 5,930 square foot gymnasium building at the southwest side of the existing school. Concrete fire lanes will also be added to the north and east ends of the project site.

The purpose of this geotechnical investigation is to evaluate the subsurface soil and groundwater conditions at the project site and develop geotechnical engineering recommendations for the proposed improvements. The scope of this geotechnical investigation is summarized below:

1. Drilling and sampling four geotechnical borings ranging from 10 to 30 feet below existing grade.
2. Soil Laboratory testing on selected soil samples.
3. Engineering analyses and recommendations for the gymnasium building addition, including building foundation type, bearing depth, allowable bearing capacity, LPile parameters, as well as floor slab and subgrade preparation.
4. Engineering analyses and recommendations for the fire lanes, including concrete pavement thickness design and subgrade preparation.
5. Construction recommendations for the proposed improvements.

2.0 SUBSURFACE EXPLORATION

2.1 Soil Boring

The boring locations and depths were selected and confirmed by Stantec prior to drilling. The boring locations were staked in the field by AEC personnel using a handheld GPS unit. AEC drilled four borings (Boring B-1 through B-4) at the project site ranging from 10 to 30 feet below existing grade. The total drilling footage is 60 feet. Boring locations were not surveyed after completion of drilling. The approximate boring locations are shown on the Boring Location Plan on Plate A-2, in Appendix A. AEC estimated boring elevations (which are included on the boring logs) based on the grading plan in the provided drawings.

2.2 Drilling and Sampling Methods

Hand Auger Boring: Due to site access issues, Boring B-1 was drilled using a hand-held auger (i.e. 3-inch diameter orchard-barrel type auger) in general accordance with ASTM D 1452. The samples were then sealed in plastic bags to reduce moisture loss and transported to the AEC laboratory for testing and further study. Groundwater readings were obtained during drilling and after completion of drilling. The borehole was backfilled with bentonite chips upon completion of drilling.

Truck Rig Borings: Borings B-2 through B-4 were drilled using a truck-mounted drilling rig and were advanced using dry auger method. Undisturbed samples of cohesive soils (including existing fill soils) were obtained from the boring by pushing 3-inch diameter thin-wall, seamless steel Shelby tube samplers in general accordance with ASTM D 1587. The undisturbed samples of cohesive soils were extruded mechanically from the tube samplers in the field and wrapped in aluminum foil; all soil samples were sealed in plastic bags to reduce moisture loss and disturbance. The samples were then placed in core boxes and

transported to the AEC laboratory for testing and further study. Groundwater readings were obtained during drilling and after completion of drilling. The boreholes were backfilled with bentonite chips upon completion of drilling.

3.0 LABORATORY TESTING PROGRAM

Soil laboratory testing was performed by AEC personnel. Samples from the borings were examined and classified in the laboratory by a technician under the supervision of a geotechnical engineer. Laboratory tests were performed on selected soil samples to evaluate the engineering properties of the subsurface soils in accordance with applicable ASTM Standards. Atterberg limits, moisture contents, percent passing a No. 200 sieve, and dry unit weight tests were performed on selected samples to establish the index properties and confirm field classification of the subsurface soils. Strength properties of cohesive soils were determined by means of unconfined compression (UC) and unconsolidated-undrained (UU) triaxial tests performed on undisturbed samples. The laboratory test results are presented on the representative boring logs (see Plates A-3 through A-6, in Appendix A). A key to the boring logs, classification of soils for engineering purposes, terms used on boring logs, and reference ASTM Standards for laboratory testing are presented on Plates A-7 through A-10, in Appendix A.

4.0 SITE CONDITIONS

4.1 Subsurface Conditions

Details of the soils encountered during drilling are presented in the boring logs on Plates A-3 through A-6, in Appendix A. Soil strata encountered in the borings are summarized below.

Boring	Depth (ft)	Description of Stratum
B-1	0 - 6	Stiff to very stiff Fat Clay (CH)
	6 - 10	Very stiff, Lean Clay (CL), with calcareous nodules
B-2	0 - 4	Stiff, Fat Clay with Sand (CH), with ferrous nodules
	4 - 12	Stiff to hard, Fat Clay (CH), with calcareous nodules
	12 - 30	Soft to very stiff, Lean Clay (CL)
B-3	0 - 2	Fill: stiff to hard, Fat Clay with Sand (CH)
	2 - 6	Hard Lean Clay, with ferrous nodules
	6 - 10	Hard, Fat Clay (CH)

Boring	Depth (ft)	Description of Stratum
B-4	0 - 2	Fill: stiff, Fat Clay (CH), with silty sand seams, and calcareous and ferrous nodules
	2 - 10	Very stiff to hard, Fat Clay (CH)

Soil Types and Expansive Potential: The subsurface soils encountered in the borings have medium to very high plasticity (see "Degree of Plasticity of Cohesive Soils" on Plate A-8, in Appendix A), with a liquid limit (LL) ranging from 32 to 68, and a plasticity index (PI) ranging from 18 to 50. The cohesive soils encountered are classified as "CH" and "CL" type soils in accordance with ASTM D 2487. "CH" soils undergo significant volume changes due to seasonal changes in soil moisture contents. "CL" type soils with lower LL (less than 40) and PI (less than 20) generally do not undergo significant volume changes with changes in moisture content. However, "CL" soils with LL approaching 50 and PI greater than 20 essentially behave as "CH" soils and could undergo significant volume changes. Slickensides were encountered in some of the clay soils.

Groundwater Conditions: A summary of groundwater levels and boring cave in depths encountered in the borings during drilling and at completion of drilling is presented in Table 1. The information in this report summarizes conditions found on the date the borings were drilled. However, it should be noted that our groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress.

Table 1. Groundwater Levels and Cave-in Depths in Borings

Boring No.	Date Drilled	Boring Depth (ft)	Boring Groundwater Depth (ft)	Boring Cave-in Depth (ft)
B-1	3/10/2025	10	Dry (Drilling) Dry (Complete)	N/A
B-2	3/10/2025	30	19 (Drilling) 17 (Complete)	26.6 (Complete)
B-3	3/10/2025	10	Dry (Drilling) Dry (Complete)	N/A
B-4	3/10/2025	10	Dry (Drilling) Dry (Complete)	N/A

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4.2 Hazardous Materials

No signs of visual staining or odors were encountered during field drilling or during processing of the soil samples in the laboratory. However, AEC notes that the presence of potential hazardous material at other locations within the project area cannot be discounted based upon the very small and limited number of samples taken.

4.3 Subsurface Variations

It should be emphasized that: (i) at any given time, groundwater depths can vary from location to location, and (ii) at any given location, groundwater depths can change with time. Groundwater depths will vary with seasonal rainfall and other climatic/environmental events. It should be noted that the division of soil strata presented herein is based on available data and interpretations at the time of investigation. Subsurface conditions may vary away from and in between the boring locations.

Clay soils in the Greater Houston area typically have secondary features such as slickensides, calcareous and ferrous nodules, and contain sand/silt seams/lenses/layers/pockets. It should be noted that the information in the boring logs is based on 3-inch diameter soil samples. For Borings B-1, B-3, and B-4, soil samples were obtained continually at 2 foot intervals from the ground surface to the boring termination depth of 10 feet. For Boring B-2, soil samples were obtained in the boring continuously at intervals of 2 feet from the ground surface to a depth of 20 feet below grade, and then at 5 foot intervals thereafter to the boring termination depth of 30 feet. A detailed description of the soil secondary features may not have been obtained due to the small sample size and sampling interval between the samples. Therefore, while a boring log shows some soil secondary features, it should not be assumed that the features are absent where not indicated on the boring logs.

5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Based on the 50 percent CD Submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a 5,930 square foot gymnasium building at the southwest side of the existing school. Based on the provided drawings, the proposed finished floor elevation (FFE) of the gymnasium building is 72.09 feet Mean Sea Level (MSL). Existing grade within the footprint of the gymnasium building varies from approximately 71 to 71.5 feet MSL. Approximately 0.6 to 1.1 feet of fill

material will be required to raise existing grade to FFE. AEC also understands that fire lanes will be constructed along the north and east borders of the project area. According to FBISD, the new fire lanes will be constructed with concrete pavement.

Construction Specifications: AEC is not aware if there are specific construction specifications for FBISD projects. For this report, AEC has instead referred to City of Houston Standard Construction Specifications (COHSCS). AEC should be notified if different construction specifications should be used.

5.1 Gymnasium Building Addition

Soil and Groundwater Conditions: Based on Boring B-2, the soil conditions at the proposed gymnasium building addition generally consist of stiff to hard fat clay (CH) to 12 feet below the existing ground surface, underlain by soft to very stiff lean clay (CL) to a depth of 20 feet. Groundwater was encountered at a depth of 19 feet during drilling and at a depth of 17 feet at the completion of drilling.

5.1.1 Building Foundations

Based on Boring B-2, AEC notes that the top 10 feet of soil at the building addition generally consist of clay soils with PI ranging from 34 to 50, which indicates a high to very expansive potential (see Degree of Plasticity of Cohesive Soils on Plate A-8, in Appendix A).

AEC notes that highly expansive clays within the zone of seasonal moisture variation will experience significant amounts of shrink and swell movements as their moisture contents vary throughout the years. AEC recommends that the building foundations be placed below the zone of seasonal moisture variation (which is typically 10 feet below grade in the Greater Houston area). AEC therefore recommends the building addition should be supported on drilled and underreamed footings that are founded at a depth of at least 10 feet below existing grade.

Allowable Bearing Capacity and Footing Depth: Drilled and underreamed footings founded at a depth of approximately 10 feet below existing grade (i.e. bearing at an elevation of approximately 61 feet MSL) should be designed for an allowable bearing capacity of 2,100 pounds per square foot (psf) for sustained loads and an allowable bearing capacity of 3,150 psf for total loads. The allowable bearing capacities provided include a factor of safety (FS) of 3 for sustained loads and a FS of 2 for total loads. Whichever net

allowable bearing capacity results in a larger footing diameter should be used for design.

LPile Soil Parameters: Design LPile soil parameters that can be used for foundation lateral load design are presented on Plate B-1, in Appendix B. For the LPile parameters, AEC conservatively considered the top 3 feet of soil of the borings to be weak soil (either soft clay or very loose sand, regardless of its actual soil condition), to account for potential desiccation and shrinkage of the near surface clays or disturbance caused by construction.

Vertical Reinforcing Steel: To withstand tensile forces resulting from the shrink/swell movements of clay soils in the moisture active zone, each footing should be designed to contain reinforcing steel throughout its full length sufficient to resist a tensile load of at least 36d kips, where "d" is the diameter of the shaft in feet.

Footing Spacing: To reduce stress overlap from adjacent footings and potential construction problems, the minimum edge-to-edge clear spacing between the underreams should not be less than 0.6 x diameter of the larger underream.

Footing Settlements: A detailed settlement analysis is beyond the scope of this investigation. Based on the soil conditions encountered and the anticipated structural loads, we estimate that drilled-and-underreamed footings, designed and constructed as recommended in this report, will experience total settlements on the order of 1 inch.

Drilled-and-Underreamed Footing Construction: Drilled-and-underreamed footings should be constructed in accordance with Section 02465 of the 2023 COHSCS. A qualified geotechnical technician should check each footing excavation prior to placing concrete to ensure that:

1) The footing has been constructed to the specified dimensions at the recommended depth and founded in the correct formation as indicated in this report;
2) The column is concentric with the pier cap/grade beam and drilled footing; and
3) Excessive cuttings, any soft or compressible materials, and ponded water are removed from the bottom of the excavation.

There is a possibility that slickensides and/or pockets/seams of sands/silts within the clay soils may make excavation difficult and result in potential sloughing or caving-in of the footing excavation sidewalls during construction.

Based on Boring B-2, AEC anticipates that the drilled and underreamed footings will be excavated within stiff to hard fat clay (CH) material. Based on Table 1 in Section 4.1 of this report, groundwater was encountered in Boring B-2, but at an initial depth below the recommended footing depth of 10 feet. AEC recommends that the underream to shaft diameter not exceed 2:1 if possible. Furthermore, AEC recommends that the underream diameter not exceed 6 feet. However, it should be noted that our groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress. If ground water is encountered within the cohesive soils during construction, sump pumps may be used to pump water out from the excavations and soft sediments should be removed. However, if significant sloughing or caving occurs during shaft excavation, further excavation should be stopped and a reduced bell/shaft ratio or even straight-sided shafts (matching the bell diameter) in combination with bentonite slurry and/or temporary casing may be necessary.

Placement of concrete should be accomplished immediately after excavation is completed to reduce potential for sloughing of the foundation soils. Footing excavations should not be left open overnight. No concrete should be placed without the prior approval of FBISD's Representative. New drilled footings should not be excavated within 2 bell diameters or 15 feet (edge to edge), whichever is larger, of an open footing excavation, or one in which concrete has been placed in the preceding 24 hours, to prevent movement of fresh concrete from the recently filled footing to an adjacent unfilled footing.

5.1.2 Building Floor Slab

As noted in Section 5.0 of this report, the proposed FFE of the gymnasium building is 72.09 feet MSL. Existing grade within the footprint of the gymnasium building varies from approximately 71 to 71.5 feet MSL. Approximately 0.6 to 1.1 feet of fill material will be required to raise existing grade to FFE.

Estimated Soil Movements: Potential Vertical Rise (PVR) is an estimate of the potential of an expansive soil to swell from its current state. PVR was computed using Texas Department of Transportation (TxDOT) test method Tex-124-E. Based on Boring B-2, the existing soil at the proposed gymnasium building is highly expansive. For the top 10 feet of soils encountered in Boring B-2, AEC estimated a PVR of 2.9 inches for the gymnasium building based on in-situ moisture contents. Expansive clays exhibit a potential to shrink and swell with changes in their moisture contents. The changes in the soil moisture content are

usually caused by variations in the seasonal amount of rainfall and evaporation rates or other localized factors like the moisture withdrawal by nearby trees. The seasonal moisture active zone generally extends to about 10 feet below ground in the Greater Houston area and will be deeper if trees with deep root zones exist adjacent to the structures.

Additional movements can occur in areas if water is allowed to pond during or after construction on soils with high plasticity, or if highly plastic soils are allowed to dry out prior to fill or concrete placement. High plasticity clay may also experience shrinkage during periods of dry weather as moisture evaporation occurs at the ground surface and the groundwater table drops. The actual PVR of the site will be highly dependent upon the actual PI and moisture regime of the clayey soils at the time of construction. Therefore, uniformity and preservation of the moisture contents of the near surface clays during construction and during the life of the structure is critical to reducing potential shrink-swell movement of the floor slab.

Table 2. Estimated PVR vs. Thickness of Replacement Fill for Gymnasium Building

Thickness of Replacement Fill Beneath the Existing Ground Surface (ft)	PVR (in), based on Boring B-2
0 (EL ~ 71')	2.9
1 (EL ~ 70')	2.7
2 (EL ~ 69')	2.5
3 (EL ~ 68')	2.2
4 (EL ~ 67')	1.9
5 (EL ~ 66')	1.6
6 (EL ~ 65')	1.3
7 (EL ~ 64')	1.0

Floor Slab: AEC understands that the PVR requirement for buildings is typically considered to be 1 inch. In accordance with Table 2, a minimum of 7 feet of soil excavation would be required to reduce the PVR of the building to 1 inch.

For the building addition, AEC recommends the following floor slab options be considered: (i) Option 1 - a structural floor slab supported on drilled and underreamed footings with a 6 inch void space between the bottom of the slab and the top of the subgrade soils; (ii) Option 2 - a subgrade supported floor slab, with 4 feet excavation and replacement of existing soils beneath the slab (although this method will still result in a

PVR that is higher than 1 inch); or (iii) Option 3 - a subgrade supported floor slab, with treatment of the underlying soils by injecting an ionic soil stabilizer (ISS) to a depth of 10 feet.

5.1.2.1 Option 1 - Structural Floor Slab

The most effective method to mitigate movement of subgrade soils due to shrink-swell cycles of expansive soils is construction of a drilled-footing supported structural floor slab with 6 inch carton forms between the bottom of the slab and the top of the subgrade soil.

Subgrade Preparation: Subgrade preparation should extend a minimum of 5 feet beyond the floor slab perimeter. Existing base, pavement, or other structures should first be demolished and removed. After demolition, minimum 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organic or deleterious materials to greater depths.

The exposed subgrade should then be proof-rolled in accordance with Item 216 of the 2024 TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with clean onsite clay soils. Afterwards, general clay fill can be placed and compacted to achieve the elevation at the bottom of the carton forms. General clay fill recommendations are presented in Section 5.3.3 of this report.

Grade Beams: We recommend that foundation grade beams be founded at least 24 inches below FFE. The grade beams should be constructed on 6 inch carton forms. Care should be taken so that the carton forms do not collapse during concrete placement and will not be exposed to water in the grade beam excavations. Surface water should not be allowed to seep into and remain in the carton form space during the life of the structures. AEC recommends that Motz blocks (or equivalent system) be used to prevent soil from filling the void beneath the grade beam after the carton forms have decayed. The drilled and underreamed footings and beams should be tied together.

Floor slabs are typically structurally tied to the grade beams, although this will be at the building designer's discretion. Alternatively, isolating the floor slabs from grade beams with a flexible impervious compound will be beneficial to reduce the potential for slab cracking due to differential soil movement; however, its

use will not mitigate the total and differential PVR movements, and the floor slabs are expected to move corresponding to the subgrade soils.

Moisture Barrier: To prevent mildew or mold growth on the underside of the structural floor slab, we recommend that a horizontal moisture barrier (minimum 10-mil thick) be placed below the concrete slab (on top of the carton forms).

5.1.2.2 Option 2 - Subgrade Supported Floor Slab

In accordance with Table 2 in Section 5.1.2 of this report, approximately 7 feet of existing soil would have to be removed and replaced with low-expansive select fill in order to achieve a PVR of 1 inch; however, this approach is most likely cost-prohibitive and impractical. In addition, thick layers of compacted fill will also experience vertical and differential settlement of the fill over time. Instead of excavating and replacing 7 feet of existing soil, **a concrete slab-on-grade in conjunction with *limited* (i.e. 4 feet) fill replacement can be considered as an alternative to full-depth replacement, if FBISD is willing to take some risk of floor slab movement**. This option assumes that uniformity and preservation of the moisture contents of the near surface clays during construction and during the life of the structure are maintained adequately, and that any resultant movements can be adequately sustained by the subgrade soils and foundation system.

It is AEC's experience that the majority of imported "select" fill that is being excavated from borrow pits in the Houston area is of poor quality and does not meet AEC's select fill specifications (see Section 5.3.2 of this report). Imported "select fill" material typically has a high sand/silt content combined with large clay boulders/chunks and is not homogenous. This material is permeable, which will allow surface water to infiltrate through it and cause both the clay boulders within the fill to swell and will also penetrate through the sand/silt and then cause the underlying natural clay soils to swell as well, resulting in significant floor slab movement and cracking.

Based on the expansive soils encountered in Boring B-2 at the building location, **AEC recommends the use of lime-stabilized clay fill for this project over using imported "select" fill for the soil replacement beneath the subgrade supported floor slab. If FBISD decides to use select clay fill instead of lime-stabilized clay fill, AEC cautions that stringent quality control (QC) over select clay fill material imported to the site should be observed**, both by FBISD's inspectors and the onsite CMT laboratory. Without proper QC, there is a risk that substandard select fill will either have a higher than allowed

expansive potential or a higher than allowed sand content, both of which will result in potential long term issues for the floor slab performance.

Using the lime stabilized clay soil will be beneficial for the overall performance of the building floor slab because: (i) it will reduce the potential for surface water to enter into the highly expansive natural clay soils beneath the building pad which in turn will reduce the potential for the subgrade clays to shrink and swell; (ii) it will be subject to less vertical and differential settlement as the fill consolidates over time; and (iii) it will provide a competent working surface during construction of the building pad. Lime-stabilized clay recommendations are presented in Section 5.3.1 of this report.

Subgrade Preparation: Subgrade preparation should extend a minimum of 5 feet beyond the floor slab perimeter. Existing base, pavement, or other structures should first be demolished and removed. After demolition, minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organic or deleterious materials to greater depths.

After surface stripping, an additional 3.5 feet [i.e. total depth of 4 feet (excavate to an elevation of approximately 67 feet MSL), which includes the 6 inches of surface removal] of existing soils should be removed. After the overburden is excavated, the exposed subgrade should be proof-rolled in accordance with Item 216 of the 2024 TxDOT Standard Specifications to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted lime-stabilized clay fill or select clay fill as necessary. After proof rolling is performed, either compacted lime-stabilized clay fill or compacted “select” clay fill should then be used to achieve the bottom of the building floor slab. Lime-stabilized clay fill and select clay fill recommendations are presented in Sections 5.3.1 and 5.3.2 of this report, respectively.

According to Table 2 in Section 5.1.2 of this report, **the PVR for 4 feet of soil replacement will still be 1.9 inches. FBISD should be aware that some risk of floor slab movement is still present if this floor slab option is selected**. If conditions which exacerbate moisture variations such as the presence of trees, poor drainage, excessive drying/wetting of subsurface soils, or leaking underground utilities are located nearby, the floor slab total vertical movements and net differential vertical movements could be higher than estimated. If a lower PVR risk is desired, AEC recommends that either a structural slab Option 1, see

Section 5.1.2.1 of this report) or ISS stabilization (Option 3, see Section 5.1.2.3 of this report) be considered instead.

Grade Beams: We recommend that foundation grade beams be founded at least 30 inches below FFE. If desired, the grade beams can be constructed on 6 inch carton forms (at the sole discretion of the building designer). If carton forms are used, however, care should be taken so that the carton forms do not collapse during concrete placement and will not be exposed to water in the grade beam excavations. Surface water should not be allowed to seep into and remain in the carton form space during the life of the structures. If carton forms are used, AEC recommends that Motz blocks (or equivalent system) be used to prevent soil from filling the void beneath the grade beam after the carton forms have decayed. If no carton forms will be used, we recommend that tensile reinforcement be placed in both top and bottom of the beams. The drilled and underreamed footings and beams should be tied together.

Floor slabs are typically structurally tied to the grade beams. Alternatively, isolating the floor slabs from grade beams with a flexible impervious compound will be beneficial to reduce the potential for slab cracking due to differential soil movement; however, its use will not mitigate the total and differential PVR movements, and the floor slabs are expected to move corresponding to the subgrade soils.

Moisture Barrier: We recommend that a horizontal moisture barrier (minimum 10-mil thick) be placed below the concrete slab to move edge effects away from the slab and mitigate seasonal fluctuations of water content directly below the structure.

5.1.2.3 Option 3 - Inject Ionic Soil Stabilizer

Option 3 also includes a subgrade supported floor slab; however, to limit the PVR impact on the floor slab, the existing expansive clay soils within the building footprint can be injected with an ISS to a minimum depth of 10 feet (without requiring over-excavation of existing soil, as presented in Option 2 in Section 5.1.2.2 of this report). Injection of a liquid ISS, such as Earthlok Soil Stabilizer (or equivalent product), should be able to reduce the potential of the expansive clay soils from experiencing shrink and swell movements and therefore prevent the building floor slab from experiencing distress in the future due to movement of expansive soils. However, although research has been conducted to determine the effectiveness of ionic clay soil stabilization, this treatment method has not yet achieved widespread acceptance and no national standard (by the federal government or professional civil engineering body) is

currently available. **The effectiveness of injecting liquid ISS in an effort to reduce the expansive potential of clay soils cannot be guaranteed by AEC**, especially in regard to: (i) the ability of the ISS to render the clay effectively inert; and (ii) for the ISS to adequately penetrate/permeate vertically and horizontally throughout the clay mass. **If the ISS injection treatment method is used, AEC will accept no liability regarding its effectiveness to reduce/prevent shrink and swell movements of expansive clay soils, or on the long-term performance of the building floor slabs (and any floor slab distress that could potentially occur)**.

AEC notes that an injection depth of 10 feet should be able to cover existing expansive clay soils within the moisture active zone; if treatment is effective, then the anticipated PVR of the floor slab should be on the order of 1 inch, or less. AEC suggests that the grid spacing of the injection points be close enough to ensure that the expansive clay soils within the treatment area be adequately treated; some degree of overlap between treated soil columns is recommended. However, the ultimate determination of treatment area, injection spacing, treatment depth, as well as means and methods for liquid ISS injection shall be by the ISS Contractor.

Subgrade Preparation: Subgrade preparation should extend a minimum of 5 feet beyond the floor slab perimeter. Existing base, pavement, or other structures should first be demolished and removed. After demolition, a minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The exposed subgrade should then be proof-rolled, in accordance with Item 216 of the 2024 TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted general fill. After proof-rolling, the ISS can be injected to a minimum depth of 10 feet below grade; the center to center spacing of the ISS injections should be determined by the ISS provider.

Testing: AEC understands that Earthlok requires that geotechnical soil testing be performed after soil stabilization is completed for warranty purposes. AEC recommends that soil borings be performed to a depth of 10 feet within the ISS treated areas. Recommended laboratory tests include, but are not necessarily limited to moisture contents, Atterberg Limits, and swell tests. Frequency of borings and laboratory testing can be determined once the ISS treatment is completed. The additional borings and testing can be performed by either AEC or a different CMT laboratory, although AEC must be allowed to review the test results if the testing is performed by others.

Grade Beams: We recommend that foundation grade beams be founded at least 30 inches below FFE. We recommend that tensile reinforcement be placed in both top and bottom of the beams. The drilled footings and beams should be tied together.

Floor slabs are frequently structurally tied to the grade beams, although this will be at the building designer's discretion. Alternatively, isolating the floor slabs from grade beams with a flexible impervious compound will be beneficial to reduce the potential for slab cracking due to differential soil movement; however, its use will not mitigate the total and differential PVR movements, and the floor slabs are expected to move corresponding to the subgrade soils.

Moisture Barrier: We recommend that a horizontal moisture barrier (minimum 10-mil thick) be placed below the concrete slab to move edge effects away from the slab and mitigate seasonal fluctuations of water content directly below the structure.

5.2 Fire Lanes

AEC notes that the amount of traffic and vehicle loading for the fire lanes was not available at the time this report was prepared. However, based on the provided drawings, the two fire lanes do not connect so AEC assumes that traffic on the fire lanes will be low and will consist primarily of passenger vehicles and delivery trucks (for parking and loading/offloading), and emergency vehicles. AEC notes that the provided drawings do not show proposed grading for the fire lane alignments. AEC assumes that the new fire lanes will be constructed at or near existing grade.

The pavement design recommendations developed herein are in accordance with the "AASHTO Guide for Design of Pavement Structures," 1993 edition.

5.2.1 Rigid Pavement

Rigid pavement design is based on the anticipated design number of 18-kip Equivalent Single Axle Loads (ESALs) the pavement is subjected to during its design life. The parameters that were used in computing the rigid pavement sections are as follows:

Overall Standard Deviation (S_0)	0.35
Initial Serviceability (P_0)	4.5
Terminal Serviceability (P_t)	2.0
Reliability Level (R)	85% (fire lanes)
Overall Drainage Coefficient (C_d)	1.0
Load Transfer Coefficient (J)	3.2
Loss of Support Category (LS)	1.0
Roadbed Soil Resilient Modulus (M_R)	1,500 psi (Borings B-1 through B-4)
Elastic Modulus (E_{sb}) of Stabilized Soils	30,000 psi
Composite Effective Modulus of Subgrade Reaction (k)	42 pci
Concrete Compressive Strength	3,500 psi (at 28 days)
Mean Concrete Modulus of Rupture (S'_c)	600 psi (at 28 days)
Concrete Elastic Modulus (E_c)	3.37 x 10^6 psi

The recommended pavement sections for the fire lanes are provided on Table 3 below. Recommended sections for parking/light duty and driveways are also included in Table 3, if needed.

Table 3. Recommended Concrete Pavement Sections

Pavement Layer	Thickness (in)		
	Parking/Light Duty	Driveways	Bus Lane/Fire Lane/Heavy Duty
Portland Cement Concrete	5	6	7
Stabilized Subgrade[(a)]	6	6	6
Estimated 18-kip ESAL Load Capacity	109,295	326,266	835,608

Note: (a) Subgrade stabilization recommendations are presented in Section 5.2.2 of this report.

AEC used the AASHTO Darwin v3.0 computer program to perform rigid pavement design. The design engineer should verify whether the proposed pavement sections will provide enough ESALs for the anticipated amount of site traffic. AEC should be notified if different standards or constants are required for pavement design at the site, so that our recommendations can be updated accordingly.

Concrete Pavement: Portland Cement Concrete (PCC) pavement should be constructed in accordance with Section 02751 of the 2023 COHSCS. The provided drawings indicate that the concrete will have a minimum compressive strength of 3,500 psi at 28 days. Based on this minimum compressive strength, AEC selected a concrete minimum flexural strength of 600 psi at 28 days. The Contractor shall be responsible for ensuring that a concrete mix design based on concrete compressive strength of 3,500 psi at 28 days also meets a minimum concrete flexural strength of 500 psi at 7 days and 600 psi at 28 days.

Reinforcing Steel: Reinforcing steel is required to control pavement cracks, deflections across pavement joints and resist warping stresses in rigid pavements. The cross-sectional area of steel (A_s) required per foot of slab width can be calculated as follows (for both longitudinal and transverse steel).

$$A_s = FLW/(2f_s) \quad \text{.....Equation (1)}$$

where: A_s = Required cross-sectional area of reinforcing steel per foot width of pavement, in^2
F = Coefficient of resistance between slab and subgrade, F = 1.8 for stabilized soil
L = Distance between free transverse joints or between free longitudinal edges, ft.
W = Weight of pavement slab per foot of width, lbs/ft
f_s = Allowable working stress in steel, 0.75 x (yield strength), psi
i.e. f_s = 45,000 psi for Grade 60 steel.

AEC evaluated the size and spacing of reinforcing steel required for the proposed concrete pavements. The provided drawings indicate a maximum expansive longitudinal joint spacing of 60 feet. Minimum reinforcing steel quantities are presented on Table 4.

Table 4. Minimum Reinforcing Steel for Concrete Pavements

Pavement	Pavement Thickness (in)	Maximum Expansion Joint Spacing (ft)	Rebar Grade	Bar Size	Bar Spacing, OCEW[(a)] (in)
Parking/Light Duty	5	60	60	#4	24
Driveways	6	60	60	#4	18
Fire Lanes/Heavy Duty	7	60	60	#4	18

Note: (a) OCEW = On Center Each Way.

5.2.2 Pavement Subgrade

As noted in Section 5.2 of this report, AEC assumes pavement areas will be at or near existing grade, whereas other areas will require either cut or fill to achieve design grade. AEC anticipates that general clay fill will be used to achieve design grade, where required. General clay fill should be in accordance with Section 5.3.3 of this report. Based on AEC's borings, the subgrade soils across the site generally consist of fat clay (CH) soils with high to very high expansive potential (see "Degree of Plasticity of Cohesive Soils" on Plate A-8, in Appendix A). AEC recommends that the pavement subgrade be stabilized to a depth of 6

inches with a minimum of 7 percent hydrated lime (by dry soil weight). Areas where general clay fill will be placed to achieve final grade should also be stabilized with hydrated lime.

Subgrade Preparation: Subgrade preparation should extend a minimum of 2 feet beyond the paved area perimeters. We recommend that a minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organics and deleterious materials to greater depths. The exposed soils should be proof-rolled in accordance with Item 216 of the 2024 TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted general clay fill. General clay fill recommendations are presented in Section 5.3.3 of this report.

After proof rolling, scarify the exposed subgrade to a depth of 6 inches and stabilize with a minimum of 7 percent hydrated lime. Lime stabilization shall be performed in accordance with Section 02336 of the 2023 COHSCS. The percentage of lime required for stabilization is a preliminary estimate for planning purposes only; laboratory testing should be performed to determine optimum lime content via ASTM D-6276 (i.e. minimum lime content to achieve a pH of 12.4) for stabilization prior to construction. The stabilized soils should be compacted to 95 percent of their ASTM D698 (Standard Proctor) dry density at a moisture content ranging from optimum to 3 percent above optimum.

5.3 Fill Requirements

5.3.1 Lime Stabilized Clay Fill

Soils Stabilized with Hydrated Lime: AEC prefers that lime-stabilized clay be used as structural fill. Either: (i) imported lime-stabilized clay soils (stabilized offsite before delivery to the project site); or (ii) clay soils excavated onsite and treated with hydrated lime can be used. Clay soils excavated onsite should first be stabilized with a minimum of 7 percent hydrated lime (by dry soil weight). The amount of hydrated lime provided in this report is for estimation purposes only. The actual amount of lime required for stabilization should be determined by lime-series curve or pH method in a laboratory prior to construction. Lime stabilization should be done in general accordance with Section 02336 of the 2023 COHSCS. AEC prefers using stabilized soil as structural fill since compacted stabilized soil generally has high strength, low compressibility, and relatively low permeability.

Lifts and Compaction: Lime-stabilized clay fill should be placed in loose lifts not exceeding 8 inches in thickness. Backfill within 3 feet of walls or columns should be placed in loose lifts no more than 4-inches thick and compacted using hand tampers, or small self-propelled compactors.

Lime-stabilized clay should be compacted to a minimum of 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

5.3.2 Select Clay Fill

'Select' Fill: It is AEC's experience that 'select' fill material imported from sand and clay pits in the Greater Houston area is generally non-homogenous (i.e. composed of a mixture of sands, silts, and clays, instead of a homogenous sandy clay material) and of poor quality, and either contains too much sand or has large clay clods with high expansive potential. Use of this non-homogenous soil can result in poor long term performance of structures and pavements placed on top of the fill.

Select fill (whether imported from offsite or is already onsite) should consist of ***uniform***, non-active inorganic lean clays with a PI between 10 and 20 percent, and more than 50 percent passing a No. 200 sieve. Material intended for use as select fill shall not have clay clods with PI greater than 20, clay clods greater than 2 inches in diameter, or contain sands/silts with PI less than 10. Sand and clay mixtures/blends are unacceptable for use as select fill. Sand/silt with clay clods is unacceptable for use as select fill. Mixing sand into clay or mixing clay into sand/silt is also unacceptable for use as select fill. **Prior to construction, the Contractor should determine if they can obtain qualified select fill meeting the above select fill criteria. The testing lab shall *reject* any material intended for use as select fill that does not meet the PI, sieve, and clay clod requirements above, unless approved otherwise by AEC.**

Lifts and Compaction: All material intended for use as select fill should be tested prior to use to confirm that it meets select fill criteria. The fill should be placed in loose lifts not exceeding 8 inches in thickness. Backfill within 3 feet of walls or columns should be placed in loose lifts no more than 4-inches thick and compacted using hand tampers, or small self-propelled compactors.

Select fill should be compacted to a minimum of 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

Testing: **If select fill will be used, at least one Atterberg Limits and one percent passing a No. 200 sieve test shall be performed for each 10,000 square feet (sf) of placed fill, per lift (with a minimum of one set of test per lift), to determine whether it meets select fill requirements.** Prior to placement of pavement or concrete, the moisture contents of the top 2 lifts of compacted select fill shall be re-tested (if there is an extended period of time between fill placement and concrete placement) to determine if the in-place moisture content of the lifts have been maintained at the required moisture requirements.

5.3.3 General Clay Fill

General clay fill can be used beneath structural floor slabs or for fill areas that will not support proposed or future structures, such as for mass site grading. AEC recommends that general clay fill consist of a clean, cohesive soil (USCS Classification "CL" or "CH"). Granular soils (i.e. sands, silts, and gravel; not more than 50 percent retained on No. 200 sieve) should not be used as general fill.

General clay fill should be placed in loose lifts not exceeding 8 inches in thickness. The fill should be compacted to 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation and Grading

To mitigate site problems that may develop following prolonged periods of rainfall, it is essential to have adequate drainage to maintain a relatively dry and firm surface prior to starting any work at the site. Adequate drainage should be maintained throughout the construction period. Methods for controlling surface runoff and ponding include proper site grading, berm construction around exposed areas, and installation of sump pits with pumps.

6.2 Construction Monitoring

Site preparation and subgrade preparation should be monitored by qualified geotechnical professionals to check for compliance with project documents and changed conditions, if encountered. AEC should be allowed to review the design and construction plans and specifications prior to release to check that the geotechnical recommendations and design criteria presented herein are properly interpreted.

7.0 LIMITATIONS

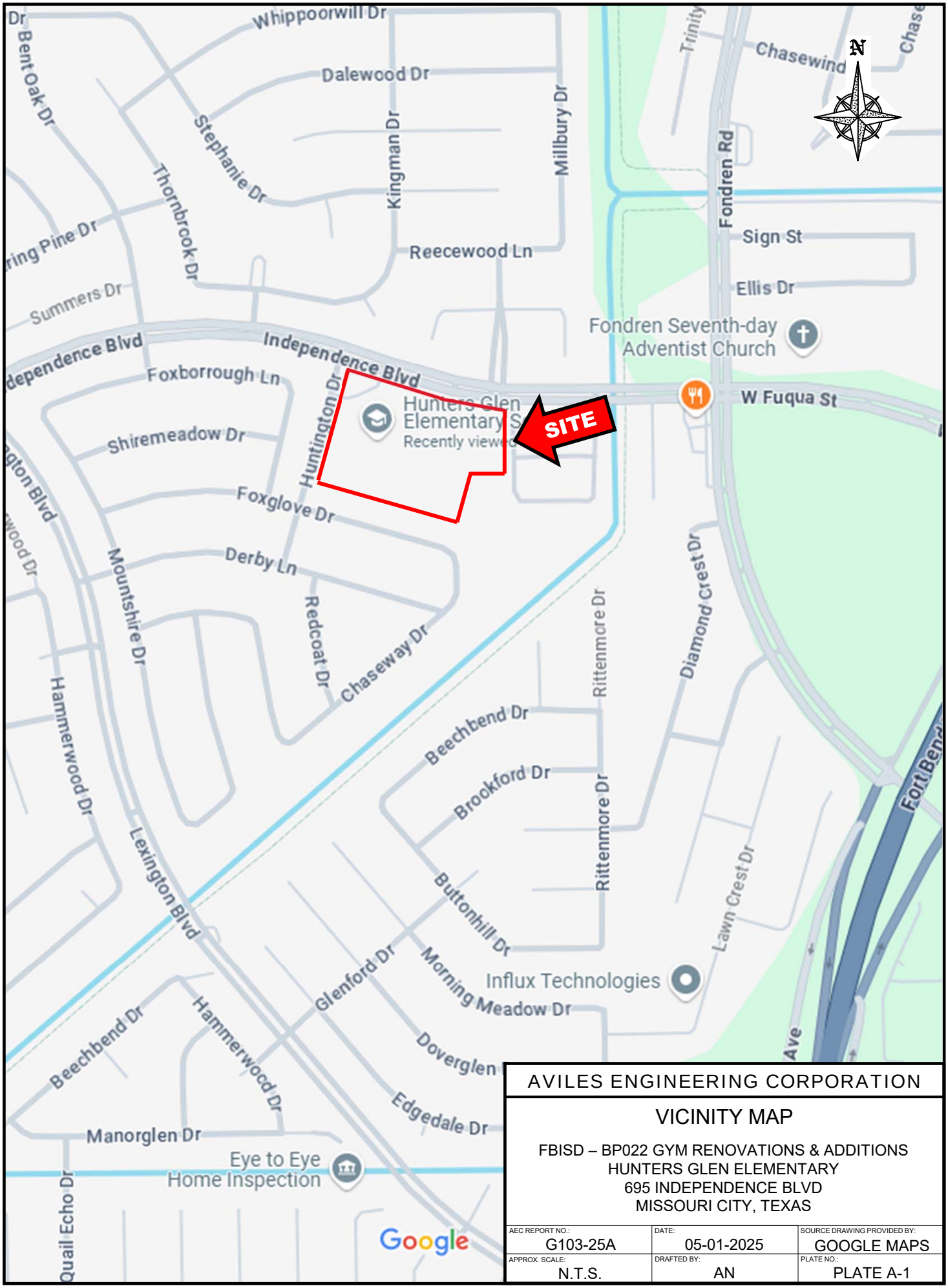
The information contained in this report summarizes conditions found on the date the borings were drilled. The attached boring logs are a true representation of the soils encountered at the specific boring locations on the date of drilling. Reasonable variations from the subsurface information presented in this report should be anticipated. AEC should be notified immediately if conditions encountered during construction are significantly different from those presented in this report.

This investigation was performed using the standard level of care and diligence normally practiced by recognized geotechnical engineering firms in this area, presently performing similar services under similar circumstances. This report is intended to be used in its entirety. The report has been prepared exclusively for the project and location described in this report. If pertinent project details change or otherwise differ from those described herein, AEC should be notified immediately and retained to evaluate the effect of the changes on the recommendations presented in this report and revise the recommendations if necessary. The scope of services does not include a fault investigation. The recommendations presented in this report should not be used for other structures located at this site or similar structures located elsewhere, without additional evaluation and/or investigation.

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APPENDIX A

Plate A-1	Vicinity Map
Plate A-2	Boring Location Plan
Plates A-3 to A-6	Boring Logs
Plate A-7	Key to Symbols
Plate A-8	Classification of Soils for Engineering Purposes
Plate A-9	Terms Used on Boring Logs
Plate A-10	ASTM & TXDOT Designation for Soil Laboratory Tests

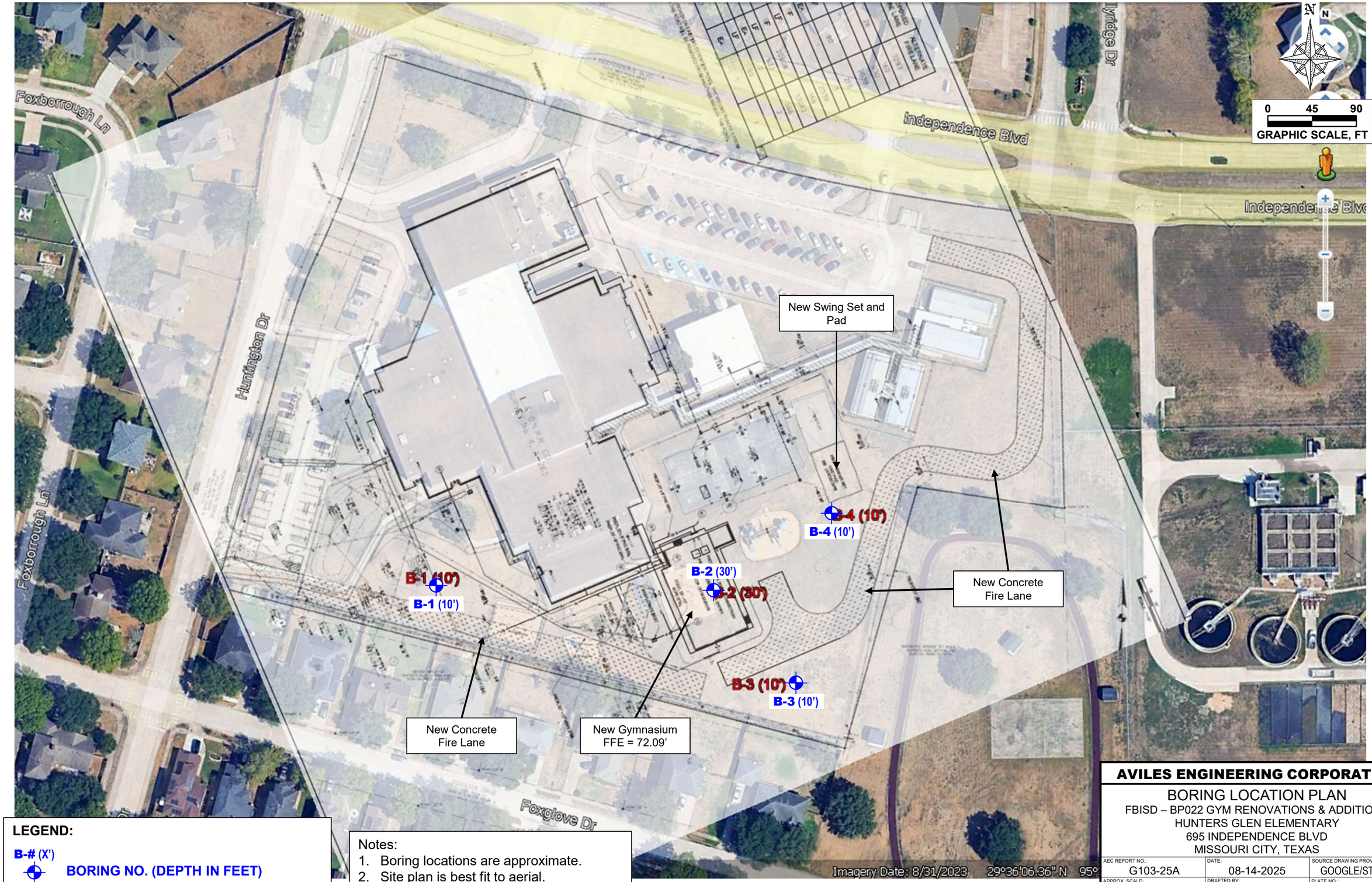


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VICINITY MAP

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
HUNTERS GLEN ELEMENTARY
695 INDEPENDENCE BLVD
MISSOURI CITY, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25A	05-01-2025	GOOGLE MAPS
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
N.T.S.	AN	PLATE A-1



LEGEND:

B-# (X')

BORING NO. (DEPTH IN FEET)

Notes:
1. Boring locations are approximate.
2. Site plan is best fit to aerial.

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BORING LOCATION PLAN

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
HUNTERS GLEN ELEMENTARY
695 INDEPENDENCE BLVD
MISSOURI CITY, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25A	08-14-2025	GOOGLE/STANTEC
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
1" = 90'	WLW	PLATE A-2

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PROJECT: Hunters Glen Elementary School BORING B-1

DATE 3/10/2025 TYPE 3" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 71				△ Confined Compression ● Unconfined Compression ○ Pocket Penetrometer □ Torvane 0.5 1 1.5 2				
0			Stiff to very stiff, gray and tan Fat Clay (CH)		23			85.8	56	17	39
			-light gray and tan 2'-6'		23						
5			-with calcareous nodules 4'-6'		23						
			Very stiff, light gray and tan Lean Clay (CL), with calcareous nodules		19						
			-with ferrous nodules 8'-10'		18						
10			Termination Depth = 10 feet								
15											
20											
25											
30											
35											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼

DRILLED BY **Aviles** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25A

PLATE A-3

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Hunters Glen Elementary School BORING B-2

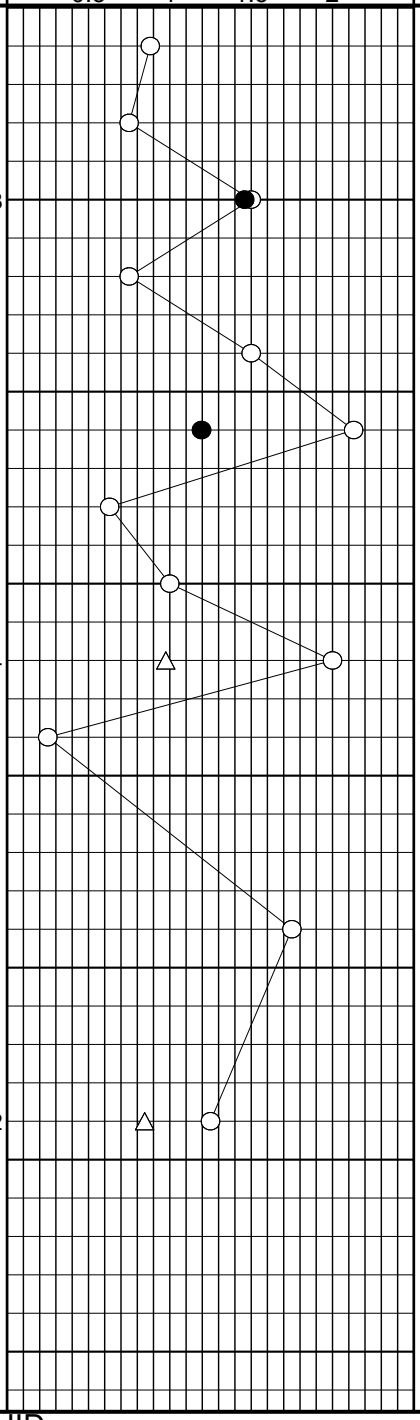
DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0	Approximate Surface Elevation (feet): 71							
0	Stiff, gray Fat Clay with Sand (CH), with ferrous nodules		29					
			27		83.3	68	18	50
5	Stiff to hard, light gray and tan Fat Clay (CH), with calcareous nodules		21	104.8				
	-with ferrous nodules 4'-6'		23					
	-with ferrous nodules 8'-12'		20		86.1	50	16	34
10	-groundwater at 11' approximately 15 minutes after initial encounter		19	110.1				
	Soft to very stiff, light gray and tan Lean Clay (CL)		26					
15	-with calcareous nodules 12'-16'		21					
	-with slickensides and silty sand seams 16'-18'		21	104.4				
	-tan 18'-20'		26		86.4	32	14	18
20								
	-with sand pockets 23'-25' and calcareous nodules 23'-30'		18					
25	-boring cave-in at 26.6' after completion of drilling							
	-with ferrous nodules 28'-30'		19	110.2				
30	Termination Depth = 30 feet							
35								

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2



BORING DRILLED TO **30** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **19** FEET WHILE DRILLING ▽
WATER LEVEL AT **17** FEET AFTER **Complete** ▽
DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25A

PLATE A-4

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Hunters Glen Elementary School BORING B-3

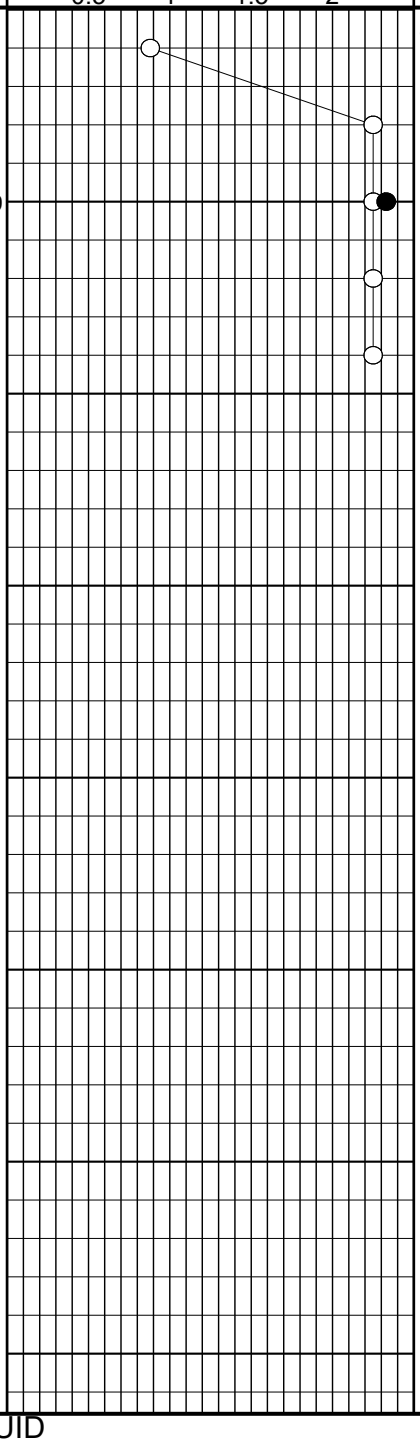
DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 71.2							
			Fill: stiff to hard, gray and tan Fat Clay with Sand (CH)		25	94.2	84.7	64	19	45
			Hard, gray and tan Lean Clay (CL), with ferrous nodules		17					
5			-with calcareous nodules 2'-4' -with sand seams 4'-6'		12	112.9				
			Hard, gray Fat Clay (CH)		17					
			-light gray and tan, with ferrous and calcareous nodules 8'-10'		19					
10			Termination Depth = 10 feet							
15										
20										
25										
30										
35										

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2



BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽
WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼
DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25A

PLATE A-5

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Hunters Glen Elementary School BORING B-4

DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 71.4				△ Confined Compression ● Unconfined Compression ○ Pocket Penetrometer □ Torvane 0.5 1 1.5 2				
0			Fill: stiff, gray and tan Fat Clay (CH), with silty sand seams and calcareous and ferrous nodules		22			89.9	56	18	38
			Very stiff to hard, gray and tan Fat Clay (CH)		24	98.5					
5			-with ferrous nodules 4'-10'		19						
			-with calcareous nodules 6'-10'		17						
			-light gray and tan 8'-10'		21						
10			Termination Depth = 10 feet								
15											
20											
25											
30											
35											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼

DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25A

PLATE A-6

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	High plasticity clay
	Low plasticity clay
	Fill
Misc. Symbols	
○	Pocket Penetrometer
	Water table depth during drilling
	Subsequent water table depth
●	Unconfined Compression
△	Confined Compression
Soil Samplers	
	Auger
	Undisturbed thin wall Shelby tube

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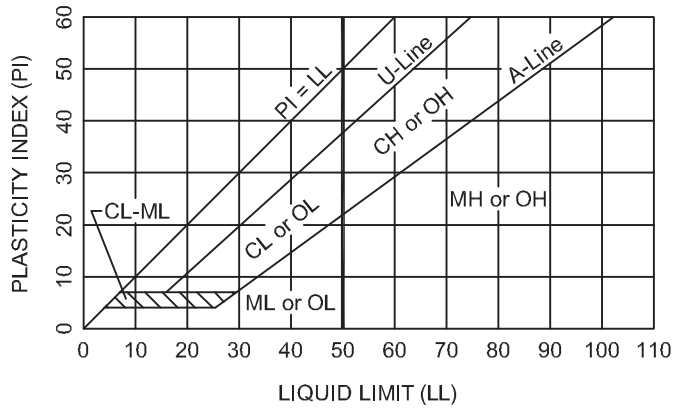
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487

MAJOR DIVISIONS				GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (Less than 50% of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well-graded gravel, well-graded gravel with sand
				GP	Poorly-graded gravel, poorly-graded gravel with sand
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	GM	Silty gravel, silty gravel with sand
			Limits plot above "A" line & hatched zone on plasticity chart	GC	Clayey gravel, clayey gravel with sand
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well-graded sand, well-graded sand with gravel
				SP	Poorly-graded sand, poorly-graded sand with gravel
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	SM	Silty sand, silty sand with gravel
			Limits plot above "A" line & hatched zone on plasticity chart	SC	Clayey sand, clayey sand with gravel
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)		SILTS AND CLAYS (Liquid Limit Less Than 50%)		ML	Silt, silt with sand, silt with gravel, sandy silt, gravelly silt
				CL	Lean clay, lean clay with sand, lean clay with gravel, sandy lean clay, gravelly lean clay
				OL	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt
		SILTS AND CLAYS (Liquid Limit 50% or More)		MH	Elastic silt, elastic silt with sand, sandy elastic silt, gravelly elastic silt
				CH	Fat clay, fat clay with sand, fat clay with gravel, sandy fat clay, gravelly fat clay
				OH	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt

NOTE: Coarse soils between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone of the plasticity chart are to have dual symbols.

PLASTICITY CHART



Equation of A-Line: Horizontal at PI=4 to LL=25.5, then PI=0.73(LL-20)

Equation of U-Line: Vertical at LL=16 to PI=7, then PI=0.9(LL-8)

DEGREE OF PLASTICITY OF COHESIVE SOILS

Degree of Plasticity	Plasticity Index
None	0 - 4
Slight	5 - 10
Medium	11 - 20
High	21 - 40
Very High	>40

SOIL SYMBOLS

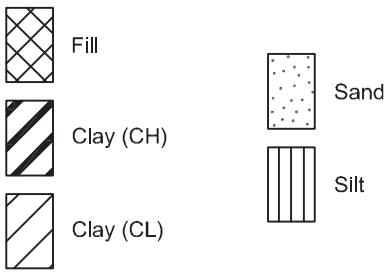


PLATE A-8

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TERMS USED ON BORING LOGS

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

6"	3"	3/4"	#4	#10	#40	#200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, Kips per Sq. ft.	SPT Blowcount
Very Soft	less than 0.25	< 2 bpf
Soft	0.25 to 0.50	2-4 bpf
Firm	0.50 to 1.00	4-8 bpf
Stiff	1.00 to 2.00	8-16 bpf
Very Stiff	2.00 to 4.00	16-32 bpf
Hard	greater than 4.00	>32 bpf

RELATIVE DENSITY OF COHESIONLESS SOILS FROM STANDARD PENETRATION TEST

Very Loose	<4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	>50 bpf

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows per Foot	Description
25	25 blows driving sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows driving sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows driving sampler 3 inches, during initial 6-inches seating interval.

NOTE: To avoid change to sampling tools, driving is limited to 50 blows during or after seating interval.

DRY STRENGTH ASTM D2488

None	Dry specimen crumbles into powder with mere pressure of handling
Low	Dry specimen crumbles into powder with some finger pressure
Medium	Dry specimen breaks into pieces or crumbles with considerable pressure
High	Dry specimen cannot be broken with finger pressure, it can be broken between thumb and hard surface
Very High	Dry specimen cannot be broken between thumb and hard surface

MOISTURE CONDITION ASTM D2488

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the easiness of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Friable	Crumbly, can be easily crushed with light pressure.
Blocky	Clays that have a block-like or polyhedral structure.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of calcium material.

ASTM & TXDOT DESIGNATION FOR SOIL LABORATORY TESTS

SOIL TEST	ASTM TEST DESIGNATION	TXDOT TEST DESIGNATION
Unified Soil Classification System	D 2487	Tex-142-E
Moisture Content	D 2216	Tex-103-E
Specific Gravity	D 854	Tex-108-E
Sieve Analysis	D 6913	Tex-110-E (Part 1)
Hydrometer Analysis	D 7928	Tex-110-E (Part 2)
Minus No. 200 Sieve	D 1140	Tex-111-E
Liquid Limit	D 4318	Tex-104-E
Plastic Limit	D 4318	Tex-105-E
Standard Proctor Compaction	D 698	Tex-114-E
Modified Proctor Compaction	D 1557	Tex-113-E
California Bearing Ratio	D 1883	-
Swell	D 4546	-
Consolidation	D 2435	-
Unconfined Compression	D 2166	-
Unconsolidated-Undrained Triaxial	D 2850	Tex-118-E
Consolidated-Undrained Triaxial	D 4767	Tex-131-E
Permeability (constant head)	D 5084	-
Pinhole	D 4647	-
Crumb	D 6572	-
Double Hydrometer	D 4221	-
pH of Soil	D 4972	Tex-128-E
Soil Suction	D 5298	-
Soil Sulfate	C 1580	Tex-145-E
Organics	D 2974	Tex-148-E

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APPENDIX B

Plate B-1 LPile Parameters for Building Foundations

Table 1. Drilled and Underreamed Footing LPile Parameters
Gymnasium Addition (Based on Boring B-2)

Depth (ft)	LPile Soil Type	γ (pcf)	γ' (pcf)	C_u (psf)	φ_u (deg.)	ε_{50}	k (pci)
0 to 3	Soft Clay (Matlock)	120	60	200	0	0.02	20
3 to 4	Soft Clay (Matlock)	120	60	1,000	0	0.009	170
4 to 8	Stiff Clay without Free Water (Reese)	127	67	1,500	0	0.008	500
8 to 10	Stiff Clay without Free Water (Reese)	131	71	1,700	0	0.007	550

Notes: (1) γ = wet unit weight of soil, γ' = buoyant unit weight of soil.
(2) C_u = cohesion, ϕ_u = angle of internal friction.
(3) ε_{50} = strain at 50% of maximum stress, k = static soil modulus for soil.
(4) Top 3 feet of soils in each boring are conservatively modeled as 'weak' soil, either very loose sand or very soft clay, regardless of actual soil condition.
(5) Highest groundwater encountered at 17 feet depth.

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
PALMER ELEMENTARY SCHOOL
4208 CROW VALLEY DRIVE
MISSOURI CITY, TEXAS

Prepared for:
Fort Bend Independent School District
Missouri City, Texas

by

Aviles Engineering Corporation
5790 Windfern
Houston, Texas 77041
713-895-7645

REPORT NO. G103-25B (Final Revision 1)

August 2025

AVILES
ENGINEERING CORP.

August 14, 2025

Ms. Nancy Lane
Fort Bend Independent School District
2323 Texas Parkway
Missouri City, Texas 77489

Reference: **Geotechnical Investigation**
Fort Bend Independent School District
BP022 - Gym Renovations and Additions
Palmer Elementary School
7208 Crow Valley Drive
Missouri City, Texas
AEC Report No.: G103-25B (Final Revision 1)

Dear Ms. Lane,

Aviles Engineering Corporation (AEC) is pleased to present this report of the results of our geotechnical investigation for the above referenced project. The project terms and conditions were performed in accordance with the Master Agreement for Professional Services between Fort Bend Independent School District (FBISD) and AEC, dated August 21, 2023. The project scope of services is in accordance with AEC Proposal No. G2024-12-01R1, dated January 10, 2025.

AEC appreciates the opportunity to be of service to you. Please call us if you have any questions or comments concerning this report or when we can be of further assistance.

Respectfully submitted,
Aviles Engineering Corporation
(TBPELS Firm Registration No. F-42)



8/14/2025

Wilber L. Wang, P.E.
Senior Engineer

Athira Nair, EIT
Staff Engineer

Reports Submitted: 1 Fort Bend Independent School District (electronic)
1 File (electronic)

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APPENDIX A

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
PALMER ELEMENTARY SCHOOL
4208 CROW VALLEY DRIVE
MISSOURI CITY, TEXAS

1.0 INTRODUCTION

The contents of this revised report (G103-25B Final Revision 1) prepared by Aviles Engineering Corporation (AEC) supersedes the report previously issued by AEC, dated July 18, 2025 (G103-25B Final).

1.1 General

The report submitted herein presents the results of Aviles Engineering Corporation's (AEC) geotechnical investigation for the Palmer Elementary School Gym Renovations and Additions project, located at 4208 Crow Valley Drive, in Missouri City, Texas, as part of the Fort Bend Independent School District (FBISD) 2023 Bond Program (FBISD Project No. BP022). A vicinity map of the project location is presented on Plate A-1, in Appendix A. AEC notes that the overall scope of the FBISD 2023 Bond Program (BP022) includes gym renovations and additions at three elementary schools: Hunter Glen Elementary School, Palmer Elementary School, and Rosa Parks Elementary School. This report, AEC Report No. G103-25B, presents recommendations for Palmer Elementary School only. Recommendations for the remaining elementary schools are presented in AEC Reports G103-25A and G103-25C, respectively.

1.2 Purpose and Scope

Based on the 50 percent CD submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a playground with a metal canopy and a 5,803 square foot gymnasium building at the northeast side of the existing school. A concrete fire lane will also be added to the to the east and north sides of the playground canopy and gymnasium building.

The purpose of this geotechnical investigation is to evaluate the subsurface soil and groundwater conditions at the project site and develop geotechnical engineering recommendations for the proposed improvements. The scope of this geotechnical investigation is summarized below:

1. Drilling and sampling five geotechnical borings ranging from 10 to 30 feet below existing grade.
2. Soil Laboratory testing on selected soil samples.
3. Engineering analyses and recommendations for the gymnasium building addition, including foundation type, bearing depth, allowable bearing capacity, as well as floor slab and subgrade preparation
4. Engineering analysis and recommendations for the canopy addition, including foundation type, bearing depth, allowable bearing capacity, uplift capacity, and LPile parameters.
5. Engineering analyses and recommendations for the fire lane, including concrete pavement thickness design and subgrade preparation.
6. Construction recommendations for the proposed improvements.

2.0 SUBSURFACE EXPLORATION

2.1 Soil Boring

The boring locations and depths at the project site were selected and confirmed by Stantec prior to drilling. The boring locations were staked in the field by AEC personnel using a handheld GPS unit. AEC drilled five borings (Boring B-1 through B-5) at the project site ranging from 10 to 30 feet below existing grade. The total drilling footage is 90 feet. Boring locations were not surveyed after completion of drilling. The approximate boring locations are shown on the Boring Location Plan on Plate A-2, in Appendix A. AEC estimated boring elevations (which are included on the boring logs) based on the grading plan in the provided drawings.

2.2 Drilling and Sampling Methods

Borings B-1 through B-5 were drilled using a truck-mounted drilling rig and were advanced using dry auger method. Undisturbed samples of cohesive soils and some disturbed samples of granular soils were obtained from the boring by pushing 3-inch diameter thin-wall, seamless steel Shelby tube samplers in general accordance with ASTM D 1587. Cohesionless soils and some samples of cohesive soils (disturbed) were sampled with a 2-inch split-barrel sampler in accordance with ASTM D 1586. Standard Penetration Test resistance (N) values for these samples were recorded as “Blows per Foot” and are shown on the boring logs. Strength of the cohesive soils was estimated in the field using a hand penetrometer. The undisturbed samples of cohesive soils were extruded mechanically from the tube samplers in the field and wrapped in aluminum foil; all soil samples were sealed in plastic bags to reduce moisture loss and disturbance. The samples were then placed in core boxes and transported to the AEC laboratory for testing and further study.

Groundwater readings were obtained during drilling. The boreholes were backfilled with bentonite chips upon completion of drilling.

3.0 LABORATORY TESTING PROGRAM

Soil laboratory testing was performed by AEC personnel. Samples from the borings were examined and classified in the laboratory by a technician under the supervision of a geotechnical engineer. Laboratory tests were performed on selected soil samples to evaluate the engineering properties of the subsurface soils in accordance with applicable ASTM Standards. Atterberg limits, moisture contents, percent passing a No. 200 sieve, and dry unit weight tests were performed on selected samples to establish the index properties and confirm field classification of the subsurface soils. Strength properties of cohesive soils were determined by means of unconfined compression (UC), unconsolidated-undrained (UU) triaxial tests and torvane tests performed on undisturbed samples. The laboratory test results are presented on the representative boring logs (see Plates A-3 through A-7, in Appendix A). A key to the boring logs, classification of soils for engineering purposes, terms used on boring logs, and reference ASTM Standards for laboratory testing are presented on Plates A-8 through A-11, in Appendix A.

4.0 SITE CONDITIONS

4.1 Subsurface Conditions

Details of the soils encountered during drilling are presented in the boring logs on Plates A-3 through A-7, in Appendix A. Soil strata encountered in the borings are summarized below.

Boring	Depth (ft)	Description of Stratum
B-1	0 - 2	Fill: hard Sandy Lean Clay (CL), with fat clay pockets, calcareous nodules and roots
	2 - 10	Very stiff to hard, Fat Clay (CH), with slickensides
B-2	0 - 2	Hard, Fat Clay with Sand (CH), with silty sand pockets and roots
	2 - 4	Very stiff to hard, Lean Clay (CL), with fat clay and silt pockets
	4 - 10	Very stiff to hard, Fat Clay (CH)
B-3	0 - 4	Very stiff to hard, Fat Clay (CH), with slickensides
	4 - 6	Clayey Sand (SC), with fat clay seams
	6 - 14	Very loose to loose, Sandy Silt (ML)
	14 - 16	Firm to very stiff, Fat Clay (CH), with silty clay seams

Boring	Depth (ft)	Description of Stratum
B-3 (cont.)	16 - 30	Loose, Silty Sand (SM)
B-4	0 - 10	Stiff to hard, Fat Clay (CH), with slickensides
	10 - 14	Sandy Silt (ML)
	14 - 16	Firm to stiff, Lean Clay (CL)
	16 - 18	Firm to stiff, Fat Clay (CH), with sandy lean clay seams
	18 - 30	Very loose, Clayey Sand (SC)
B-5	0 - 10	Hard, Fat Clay with Sand (CH), with slickensides

Soil Types and Expansive Potential: The subsurface soils encountered in the borings have high to very high plasticity (see "Degree of Plasticity of Cohesive Soils" on Plate A-9, in Appendix A), with a liquid limit (LL) ranging from 40 to 68, and a plasticity index (PI) ranging from 26 to 46. The cohesive soils encountered are classified as "CH" and "CL" type and the granular soils encountered are classified as "SC", "SM", and "ML" type soils in accordance with ASTM D 2487. "CH" soils undergo significant volume changes due to seasonal changes in soil moisture contents. "CL" type soils with lower LL (less than 40) and PI (less than 20) generally do not undergo significant volume changes with changes in moisture content. However, "CL" soils with LL approaching 50 and PI greater than 20 essentially behave as "CH" soils and could undergo significant volume changes. Slickensides were encountered in some fat clay (CH) soils.

Groundwater Conditions: A summary of groundwater levels encountered in the borings during drilling and completion of drilling is presented in Table 1. The information in this report summarizes conditions found on the date the borings were drilled. However, it should be noted that our groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress.

Table 1. Groundwater Levels in Borings

Boring No.	Date Drilled	Boring Depth (ft)	Boring Groundwater Depth (ft)
B-1	3/10/2025	10	Dry (Drilling) Dry (Complete)
B-2	3/11/2025	10	Dry (Drilling) Dry (Complete)
B-3	3/10/2025	30	14 (Drilling) 14 (15 Mins.)
B-4	3/10/2025	30	Dry (Drilling) Dry (Complete)

Boring No.	Date Drilled	Boring Depth (ft)	Boring Groundwater Depth (ft)
B-5	12/27/23	10	Dry (Drilling) Dry (Complete)

4.2 Hazardous Materials

No signs of visual staining or odors were encountered during field drilling or during processing of the soil samples in the laboratory. However, AEC notes that the presence of potential hazardous material at other locations within the project area cannot be discounted based upon the very small and limited number of samples taken.

4.3 Subsurface Variations

It should be emphasized that: (i) at any given time, groundwater depths can vary from location to location, and (ii) at any given location, groundwater depths can change with time. Groundwater depths will vary with seasonal rainfall and other climatic/environmental events. It should be noted that the division of soil strata presented herein is based on available data and interpretations at the time of investigation. Subsurface conditions may vary away from and in between the boring locations.

Clay soils in the Greater Houston area typically have secondary features such as slickensides, calcareous and ferrous nodules, and contain sand/silt seams/lenses/layers/pockets. It should be noted that the information in the boring logs is based on 3-inch or 2-inch diameter soil samples. For Borings B-1, B-2 and B-5, soil samples were obtained continuously at intervals of 2 feet from the ground surface to a depth of 10 feet below grade. For Borings B-3 and B-4, soil samples were obtained continuously at interval of 2 feet from the ground to a depth of 20 feet below existing grade, and then at 5 foot intervals thereafter to the boring termination depth of 30 feet. A detailed description of the soil secondary features may not have been obtained due to the small sample size and sampling interval between the samples. Therefore, while a boring log shows some soil secondary features, it should not be assumed that the features are absent where not indicated on the boring log.

5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Based on the 50 percent CD submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a playground with a metal canopy and a 5,803 square foot gymnasium building at the northeast side of the existing school. Based on the provided drawings, the proposed finished floor elevation (FFE) of the gymnasium building is 67.03 feet Mean Sea Level (MSL). Existing grade within the footprint of the gymnasium building varies from approximately 65.7 to 66 feet MSL. Approximately 1 to 1.3 feet of fill material will be required to raise existing grade to FFE. AEC also understands that a fire lane will be constructed to the east and north of the playground canopy and gymnasium building. According to FBISD, the new fire lane will be constructed with concrete pavement.

Construction Specifications: AEC is not aware if there are specific construction specifications for FBISD projects. For this report, AEC has instead referred to City of Houston Standard Construction Specifications (COHSCS). AEC should be notified if different construction specifications should be used.

5.1 Gymnasium Building Addition

Soil and Groundwater Conditions: Based on Boring B-3, the soil conditions at the proposed gymnasium building addition generally consists of very stiff fat clay (CH) from the existing ground surface to a depth of 4 feet, underlain by a 2 foot clayey sand (SC) layer and followed by loose to very loose sandy silt (ML) to a depth of 14 feet. A 2 foot fat clay (CH) layer was encountered further, continued by a silty sand (SM) stratum until boring termination. Groundwater was encountered at a depth of 14 feet during drilling and approximately 15 minutes after the initial encounter.

5.1.1 Building Foundations

Based on Boring B-3, the soil conditions at building addition generally consist of highly expansive fat clay (CH) with a PI of 38 to a depth of 4 feet below existing grade, which indicates a high expansive potential (see Degree of Plasticity of Cohesive Soils on Plate A-9, in Appendix A). However, clayey sands (SC) and sandy silt (ML) soils are present beneath the surficial fat clay (CH) from a depth of 4 feet to 10 feet.

AEC notes that highly expansive clays within the zone of seasonal moisture variation will experience significant amounts of shrink and swell movements as their moisture contents vary throughout the years. In

order to mitigate the impact of the expansive clays, AEC recommends that the building foundations be supported on shallow spread footings, founded at 4 feet below the existing grade. **AEC does not recommend underreamed footings to be used due to the presence of thick layers of granular soils below the surficial clay layers, as these may result in sloughing or caving in during the underream excavation.**

Allowable Bearing Capacity and Footing Depth: Spread footings founded at a depth of approximately 4 feet below existing ground surface (i.e. bearing at an elevation of approximately 62 feet MSL) should be designed for an allowable bearing capacity of 2,700 pounds per square foot (psf) for sustained loads and an allowable bearing capacity of 4,050 psf for total loads. The allowable bearing capacities provided include a factor of safety (FS) of 3 for sustained loads and a FS of 2 for total loads. Whichever net allowable bearing capacity results in a larger footing dimension should be used for design.

Backfill above Footings: Backfill (if any) placed on top of footings should consist of compacted select clay fill. Select clay fill should be in accordance with Section 5.4.2 of this report.

Footing Spacing: To reduce stress overlap from adjacent footings and potential construction problems, the minimum edge-to-edge clear spacing between the spread footings should not be less than 1 x width of the larger footing.

Footing Settlements: A detailed settlement analysis is beyond the scope of this investigation. Based on the soil conditions encountered and the anticipated structural loads, we estimate that spread footings, designed and constructed as recommended in this report, will experience total settlements on the order of 1 inch.

Spread Footing Construction: A qualified geotechnical technician should check each footing excavation prior to placing concrete to ensure that:

1) The footing has been constructed to the specified dimensions at the recommended depth and founded in the correct formation as indicated in this report;
2) The column is concentric with the grade beam and spread footing; and
3) Excessive cuttings, any soft or compressible materials, and ponded water are removed from the bottom of the excavation.

There is a possibility that slickensides and/or pockets/seams of sands/silts within the clay soils may make excavation difficult and result in potential sloughing or caving-in of the footing excavation sidewalls during construction.

AEC anticipates that the spread footings will be excavated within the fat clay (CH) soils encountered from the ground surface to a depth of 4 feet and the bottom of the excavation should bear on top of the clayey sand (SC) strata encountered from a depth of 4 to 6 feet in Boring B-3. Based on the groundwater level encountered in Boring B-3, AEC does not anticipate that groundwater will be encountered during foundation construction.

However, it should be noted that our groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress. Excavation within cohesive soils will likely encounter minimal seepage (if any) and will be able to be controlled using open drainage method (i.e., sump and pump). However, excavation within granular soils, may encounter seepage into the excavation at a rate that is greater than can be handled by open drainage method. If so, then pre-drainage method (i.e., wellpoints in sands or eductor/ejector-type systems in silts/clayey silts) may be necessary.

If the excavation extends below groundwater and the soils at or near the bottom of the excavation are mainly sands or silts, the bottom can fail by blow-out (boiling) when a sufficient hydraulic head exists. The potential for boiling or in-flow of granular soils increases where the groundwater is pressurized. To reduce the potential for boiling of excavations terminating in granular soils below pressurized groundwater, the groundwater table should be lowered at least 3 feet below the excavation. AEC recommends that a 3 to 5 foot long temporary steel casing be used for foundation construction to prevent sidewall sloughing of the foundation, if excavation proceeds further into the granular soil layer

Placement of concrete should be accomplished immediately after excavation is completed to reduce potential for sloughing of the foundation soils. Footing excavations should not be left open overnight. No concrete should be placed without the prior approval of FBISD's Representative.

5.1.2 Building Floor Slab

As noted in Section 5.0 of this report, the proposed FFE of the gymnasium building is 67.03 feet MSL.

Existing grade within the footprint of the gymnasium building varies from approximately 65.7 to 66 feet MSL. Approximately 1 to 1.3 feet of fill material will be required to raise existing grade to FFE.

Estimated Soil Movements: Potential Vertical Rise (PVR) is an estimate of the potential of an expansive soil to swell from its current state. PVR was computed using Texas Department of Transportation (TxDOT) test method Tex-124-E. For the top 10 feet of soils encountered in Boring B-3, AEC estimated a PVR of 1.6 inches for the gymnasium building based on the in-situ moisture contents. Expansive clays exhibit a potential to shrink and swell with changes in their moisture contents. The changes in the soil moisture content are usually caused by variations in the seasonal amount of rainfall and evaporation rates or other localized factors like the moisture withdrawal by nearby trees. The seasonal moisture active zone generally extends to about 10 feet below ground in the Greater Houston area and will be deeper if trees with deep root zones exist adjacent to the structures.

Additional movements can occur in areas if water is allowed to pond during or after construction on soils with high plasticity, or if highly plastic soils are allowed to dry out prior to fill or concrete placement. High plasticity clay may also experience shrinkage during periods of dry weather as moisture evaporation occurs at the ground surface and the groundwater table drops. The actual PVR of the site will be highly dependent upon the actual PI and moisture regime of the clayey soils at the time of construction. Therefore, uniformity and preservation of the moisture contents of the near surface clays during construction and during the life of the structure is critical to reducing potential shrink-swell movement of the floor slab.

PVR: For the top 10 feet of the existing soils encountered in Boring B-3, the PVR at the proposed gymnasium building is approximately 1.6 inches based on in-situ moisture conditions. Table 2 shows how the PVR of the building can be reduced by excavating existing soil and replacing it with replacement fill.

Table 2. Estimated PVR vs. Thickness of Replacement Fill for Gymnasium Building

Thickness of Replacement Fill Beneath the Existing Ground Surface (ft)	PVR (in), based on Boring B-3
0 (EL ~66')	1.6
1 (EL ~65')	1.4
2 (EL ~64')	1.2
3 (EL ~63')	0.9

Floor Slab: AEC understands that the PVR requirement for buildings is typically considered to be 1 inch. In accordance with Table 2, a minimum of 2.5 feet of soil excavation would be required to reduce the PVR of the building to 1 inch.

However, it is AEC's experience that the majority of imported "select" fill that is being excavated from borrow pits in the Houston area is of poor quality and does not meet AEC's select fill specifications (see Section 5.4.2 of this report). Imported "select fill" material typically has a high sand/silt content combined with large clay boulders/chunks and is not homogenous. This material is permeable, which will allow surface water to infiltrate through it and cause both the clay boulders within the fill to swell and will also penetrate through the sand/silt and then cause the underlying natural clay soils to swell as well, resulting in significant floor slab movement and cracking.

Based on the expansive soils encountered in Boring B-3 at the building location, **AEC recommends the use of lime-stabilized clay fill over using imported "select" fill for the soil replacement beneath the subgrade supported floor.** If FBISD decides to use select clay fill instead of lime-stabilized clay fill, AEC cautions that stringent quality control (QC) over select clay fill material imported to the site should be observed, both by FBISD's inspectors and the onsite CMT laboratory. Without proper QC, there is a risk that substandard select fill will either have a higher than allowed expansive potential or a higher than allowed sand content, both of which will result in potential long term issues for the floor slab performance.

Using the lime stabilized clay soil will be beneficial for the overall performance of the building floor slab because: (i) it will reduce the potential for surface water to enter into the highly expansive natural clay soils beneath the building pad which in turn will reduce the potential for the subgrade clays to shrink and swell; (ii) it will be subject to less vertical and differential settlement as the fill consolidates over time; and (iii) it will provide a competent working surface during construction of the building pad. Lime-stabilized clay recommendations are presented in Section 5.4.1 of this report.

Subgrade Preparation: Subgrade preparation should extend a minimum of 5 feet beyond the floor slab perimeter. Existing base, pavement, or other structures (if any) should first be demolished and removed. After demolition, minimum 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organic or deleterious materials to greater depths.

After surface stripping, an additional 2 feet [i.e. total depth of 2.5 feet (excavate to an elevation of approximately 63.5 feet MSL), which includes the 6 inches of surface removal] of existing soils should be removed. After the overburden is excavated, the exposed subgrade should be proof-rolled in accordance with Item 216 of the 2024 TxDOT Standard Specifications to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted lime-stabilized clay fill or select clay fill as necessary. After proof rolling is performed, either compacted lime-stabilized clay fill or compacted "select" clay fill should then be used to achieve the bottom of the building floor slab. Lime-stabilized clay fill and select clay fill recommendations are presented in Sections 5.4.1 and 5.4.2 of this report, respectively.

According to Table 2 above, the PVR for 2.5 feet of soil replacement will be 1 inch. However, if conditions which exacerbate moisture variations such as the presence of trees, poor drainage, excessive drying/wetting of subsurface soils, or leaking underground utilities are located nearby, the floor slab total vertical movements and net differential vertical movements could be higher than estimated.

Grade Beams: We recommend that foundation grade beams be founded at least 30 inches below FFE. We recommend that tensile reinforcement be placed in both top and bottom of the beams. The spread footings and beams should be tied together.

Floor slabs are typically structurally tied to the grade beams. Alternatively, isolating the floor slabs from grade beams with a flexible impervious compound will be beneficial to reduce the potential for slab cracking due to differential soil movement; however, its use will not mitigate the total and differential PVR movements, and the floor slabs are expected to move corresponding to the subgrade soils.

Moisture Barrier: We recommend that a horizontal moisture barrier (minimum 10-mil thick) be placed below the concrete slab to move edge effects away from the slab and mitigate seasonal fluctuations of water content directly below the structure.

5.2 Canopy Addition

Based on Boring B-4, the soil conditions at the canopy addition generally consists of stiff to hard fat clay (CH) from the ground surface to a depth of 10 feet below the existing grade, followed by sandy silt (ML) soil.

AEC recommends that the canopy foundations be supported on drilled and underreamed footings founded at 10 feet below the existing grade. **AEC does not recommend the underreamed foundations exceed 10 feet depth due to the presence of granular soils beyond 10 feet.** However, if the required lateral and uplift load resistance of the foundations are not achieved with this option, AEC recommends using straight sided drilled shafts instead. AEC should be notified if straight sided drilled shafts will be necessary to provide additional lateral and/or uplift load resistance, so that the recommendations in this report can be updated.

Drilled and underreamed footings founded at a depth of approximately 10 feet below existing grade (i.e. bearing at an elevation of approximately 55.5 feet MSL) should be designed for an allowable bearing capacity of 3,600 pounds per square foot (psf) for sustained loads and an allowable bearing capacity of 5,400 psf for total loads. The allowable bearing capacities provided include a factor of safety (FS) of 3 for sustained loads and a FS of 2 for total loads. Whichever net allowable bearing capacity results in a larger footing diameter should be used for design.

Uplift Capacity: According to O'Neill and Reese (1999), "Drilled Shafts: Construction Procedures and Design Methods", the uplift resistance of a drilled and underreamed footing in cohesive soils can be calculated as:

$$Q\ (uplift) = (s_u\ N_u\ A_u)/FS_1 + W_c/FS_2 + W_s/FS_3 \quad \text{.....Equation (1)}$$

$$N_u = 1.5\ D_b / B_b \ \leq 9 \quad \text{.....Equation (2)}$$

where:
- Q = Allowable uplift resistance of a drilled footing, lbs
- s_u = Average undrained shear strength of the cohesive soil between the base of the bell and 2 B_b above the base; use s_u = 1,450 psf, based on Boring B-4
- N_u = Bearing capacity factor for base uplift resistance, $N_u \leq 9$
- D_b = Depth of base below ground surface minus the seasonal moisture change zone for a drilled and underreamed footing, ft; the seasonal moisture change zone in Houston can be considered as 10 feet below the existing ground surface
- B_b = Diameter of the bell, ft
- B_s = Diameter of the shaft, ft
- W_c = Effective weight of concrete footing, lbs
- W_s = Effective weight of projected soil above the bell, lbs (use unit weight, γ = 120 pcf for soils above water table, and buoyant unit weight γ' = 60 pcf for soils below water table)
- A_u = $\pi/4\ (B_b^2 - B_s^2)$, projected area of bell over shaft, ft^2
- FS_1, FS_2, FS_3 = Factors of Safety for uplift resistance

AEC recommends that the following FS be used for uplift design: FS of 2 for soil cohesion ($FS_1 = 2$), FS of 1.1 for dead weight of footing ($FS_2 = 1.1$), and FS of 1.5 for weight of soil above the bell ($FS_3 = 1.5$). If the calculated uplift resistance of the foundation does not meet the uplift loading requirements, AEC recommends that a straight drilled shaft (with a shaft length greater than 10 feet) be used instead due to the presence of the cohesionless soil (i.e., silt) beneath the clay layer. AEC will provide straight sided drilled shaft recommendations if necessary.

LPile Soil Parameters: Design LPile soil parameters that can be used for foundation lateral load design are presented on Plate B-1, in Appendix B. For the LPile parameters, AEC conservatively considered the top 3 feet of soil of the borings to be weak soil (either soft clay or very loose sand, regardless of its actual soil condition), to account for potential desiccation and shrinkage of the near surface clays or disturbance caused by construction. In a similar manner to the uplift load resistance, AEC should be notified if additional lateral load resistance will be required for the canopy foundations. If so, AEC recommends that straight sided drilled shafts be used instead of drilled and underreamed footings. The shaft lengths should be increased as necessary to provide additional lateral resistance. AEC will provide straight sided drilled shaft recommendations if necessary.

Vertical Reinforcing Steel: To withstand tensile forces resulting from the shrink/swell movements of clay soils in the moisture active zone, each footing should be designed to contain reinforcing steel throughout its full length sufficient to resist a tensile load of at least 68d kips, where “d” is the diameter of the shaft in feet.

Footing Spacing: To reduce stress overlap from adjacent footings and potential construction problems, the minimum edge-to-edge clear spacing between the underreams should not be less than 0.6 x diameter of the larger underream.

Footing Settlements: A detailed settlement analysis is beyond the scope of this investigation. However, based on the soil conditions encountered and the anticipated structural loads, we estimate that drilled-and-underreamed footings, designed and constructed as recommended in this report, will experience total settlements on the order of 1 inch.

Drilled-and-Underreamed Footing Construction: Drilled-and-underreamed footings should be constructed in accordance with Section 02465 of the 2023 COHSCS. A qualified geotechnical technician should check each footing excavation prior to placing concrete to ensure that:

1) The footing has been constructed to the specified dimensions at the recommended depth and founded in the correct formation as indicated in this report;
2) The column is concentric with the pier cap/grade beam and drilled footing; and
3) Excessive cuttings, any soft or compressible materials, and ponded water are removed from the bottom of the excavation.

There is a possibility that slickensides and/or pockets/seams of sands/silts within the clay soils may make underreaming (belling) difficult and result in potential sloughing or caving-in of the shaft excavation sidewalls during construction, particularly for underreams over 6 feet in diameter. We recommend that a maximum diameter ratio of bell to shaft not exceed 2 to 1.

Based on Boring B-4, drilled and underreamed footing excavations that are 10 feet deep will encounter stiff to hard fat clay (CH). Based on the groundwater level encountered in Borings B-3 and B-4, AEC does not anticipate that groundwater will be encountered during foundation construction. However, the site's groundwater level should be expected to fluctuate with seasonal rainfall and other climatic events and may be higher at the time of construction. If ground water is encountered within the cohesive soils during construction, sump pumps may be used to pump water out from the excavations and soft sediments should be removed. However, if significant sloughing or caving occurs during shaft excavation, further excavation should be stopped and a reduced bell/shaft ratio or even straight-sided shafts (matching the bell diameter) in combination with bentonite slurry and/or temporary casing may be necessary.

Placement of concrete should be accomplished immediately after excavation is completed to reduce potential for sloughing of the foundation soils. Footing excavations should not be left open overnight. No concrete should be placed without the prior approval of the Owner's Representative. New drilled footings should not be excavated within 2 bell diameters or 15 feet (edge to edge), whichever is larger, of an open footing excavation, or one in which concrete has been placed in the preceding 24 hours, to prevent movement of fresh concrete from the recently filled footing to an adjacent unfilled footing.

5.3 Fire Lane

AEC notes that the amount of traffic and vehicle loading for the fire lane was not available at the time this

report was prepared. However, based on the provided drawings, AEC assumes that traffic on the fire lane will be low and will consist primarily of passenger vehicles and delivery trucks (for parking and loading/offloading), and emergency vehicles. AEC notes that the provided drawings do not show proposed grading for the fire lane alignment. AEC assumes that the new fire lane will be constructed at or near existing grade.

The pavement design recommendations developed herein are in accordance with the "AASHTO Guide for Design of Pavement Structures," 1993 edition.

5.3.1 Rigid Pavement

Rigid pavement design is based on the anticipated design number of 18-kip Equivalent Single Axle Loads (ESALs) the pavement is subjected to during its design life. The parameters that were used in computing the rigid pavement sections are as follows:

Overall Standard Deviation (S_0)	0.35
Initial Serviceability (P_0)	4.5
Terminal Serviceability (P_t)	2.0
Reliability Level (R)	85% (fire lane)
Overall Drainage Coefficient (C_d)	1.0
Load Transfer Coefficient (J)	3.2
Loss of Support Category (LS)	1.0
Roadbed Soil Resilient Modulus (M_R)	1,500 psi (Borings B-3 through B-5)
Elastic Modulus (E_{sb}) of Stabilized Soils	30,000 psi
Composite Effective Modulus of Subgrade Reaction (k)	42 pci
Concrete Compressive Strength	3,500 psi (at 28 days)
Mean Concrete Modulus of Rupture (S'_c)	600 psi (at 28 days)
Concrete Elastic Modulus (E_c)	3.37 x 10^6 psi

The recommended pavement sections for the fire lane are provided on Table 3 below. Recommended sections for parking/light duty and driveways are also included in Table 3, if needed.

Table 3. Recommended Concrete Pavement Sections

Pavement Layer	Thickness (in)		
	Parking/Light Duty	Driveways	Bus Lane/Fire Lane/Heavy Duty
Portland Cement Concrete	5	6	7
Stabilized Subgrade[(a)]	6	6	6

Pavement Layer	Thickness (in)		
	Parking/Light Duty	Driveways	Bus Lane/Fire Lane/Heavy Duty
Estimated 18-kip ESAL Load Capacity	109,295	326,266	835,608

Note: (a) Subgrade stabilization recommendations are presented in Section 5.3.2 of this report.

AEC used the AASHTO Darwin v3.0 computer program to perform rigid pavement design. The design engineer should verify whether the proposed pavement sections will provide enough ESALs for the anticipated amount of site traffic. AEC should be notified if different standards or constants are required for pavement design at the site, so that our recommendations can be updated accordingly.

Concrete Pavement: Portland Cement Concrete (PCC) pavement should be constructed in accordance with Section 02751 of the 2023 COHSCS. The provided drawings indicate that the concrete will have a minimum compressive strength of 3,500 psi at 28 days. Based on this minimum compressive strength, AEC selected a concrete minimum flexural strength of 600 psi at 28 days. The Contractor shall be responsible for ensuring that a concrete mix design based on concrete compressive strength of 3,500 psi at 28 days also meets a minimum concrete flexural strength of 500 psi at 7 days and 600 psi at 28 days.

Reinforcing Steel: Reinforcing steel is required to control pavement cracks, deflections across pavement joints and resist warping stresses in rigid pavements. The cross-sectional area of steel (A_s) required per foot of slab width can be calculated as follows (for both longitudinal and transverse steel).

$$A_s = FLW/(2f_s) \quad \text{.....Equation (3)}$$

where: A_s = Required cross-sectional area of reinforcing steel per foot width of pavement, in^2
F = Coefficient of resistance between slab and subgrade, F = 1.8 for stabilized soil
L = Distance between free transverse joints or between free longitudinal edges, ft.
W = Weight of pavement slab per foot of width, lbs/ft
f_s = Allowable working stress in steel, 0.75 x (yield strength), psi
i.e. f_s = 45,000 psi for Grade 60 steel.

AEC evaluated the size and spacing of reinforcing steel required for the proposed concrete pavements. The provided drawings indicate a maximum expansive longitudinal joint spacing of 60 feet. Minimum reinforcing steel quantities are presented on Table 4.

Table 4. Minimum Reinforcing Steel for Concrete Pavements

Pavement	Pavement Thickness (in)	Maximum Expansion Joint Spacing (ft)	Rebar Grade	Bar Size	Bar Spacing, OCEW[(a)] (in)
Parking/Light Duty	5	60	60	#4	24
Driveways	6	60	60	#4	18
Fire Lanes/Heavy Duty	7	60	60	#4	18

Note: (a) OCEW = On Center Each Way.

5.3.2 Pavement Subgrade

As noted in Section 5.2 of this report, AEC assumes pavement areas will be at or near existing grade, whereas other areas will require either cut or fill to achieve design grade. AEC anticipates that general clay fill will be used to achieve design grade, where required. General clay fill should be in accordance with Section 5.4.3 of this report. Based on Borings B-3 through B-5, the subgrade soils along the fire lane alignment generally consist of fat clay (CH) soils with high to very high expansive potential (see "Degree of Plasticity of Cohesive Soils" on Plate A-9, in Appendix A). AEC recommends that the pavement subgrade be stabilized to a depth of 6 inches with a minimum of 7 percent hydrated lime (by dry soil weight). Areas where general clay fill will be placed to achieve final grade should also be stabilized with hydrated lime.

Subgrade Preparation: Subgrade preparation should extend a minimum of 2 feet beyond the paved area perimeters. We recommend that a minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organics and deleterious materials to greater depths. The exposed soils should be proof-rolled in accordance with Item 216 of the 2024 TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted general clay fill. General clay fill recommendations are presented in Section 5.4.3 of this report.

After proof rolling, scarify the exposed subgrade to a depth of 6 inches and stabilize with a minimum of 7 percent hydrated lime. Lime stabilization shall be performed in accordance with Section 02336 of the 2023 COHSCS. The percentage of lime required for stabilization is a preliminary estimate for planning purposes only; laboratory testing should be performed to determine optimum lime content via ASTM D-6276 (i.e.

minimum lime content to achieve a pH of 12.4) for stabilization prior to construction. The stabilized soils should be compacted to 95 percent of their ASTM D698 (Standard Proctor) dry density at a moisture content ranging from optimum to 3 percent above optimum.

5.4 Fill Requirements

5.4.1 Lime Stabilized Clay Fill

Soils Stabilized with Hydrated Lime: AEC prefers that lime-stabilized clay be used as structural fill. Either: (i) imported lime-stabilized clay soils (stabilized offsite before delivery to the project site); or (ii) clay soils excavated onsite and treated with hydrated lime can be used. Clay soils excavated onsite should first be stabilized with a minimum of 7 percent hydrated lime (by dry soil weight). The amount of hydrated lime provided in this report is for estimation purposes only. The actual amount of lime required for stabilization should be determined by lime-series curve or pH method in a laboratory prior to construction. Lime stabilization should be done in general accordance with Section 02336 of the 2023 COHSCS. AEC prefers using stabilized soil as structural fill since compacted stabilized soil generally has high strength, low compressibility, and relatively low permeability.

Lifts and Compaction: Lime-stabilized clay fill should be placed in loose lifts not exceeding 8 inches in thickness. Backfill within 3 feet of walls or columns should be placed in loose lifts no more than 4-inches thick and compacted using hand tampers, or small self-propelled compactors.

Lime-stabilized clay should be compacted to a minimum of 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

5.4.2 Select Clay Fill

'Select' Fill: It is AEC's experience that 'select' fill material imported from sand and clay pits in the Greater Houston area is generally non-homogenous (i.e. composed of a mixture of sands, silts, and clays, instead of a homogenous sandy clay material) and of poor quality, and either contains too much sand or has large clay clods with high expansive potential. Use of this non-homogenous soil can result in poor long term performance of structures and pavements placed on top of the fill.

Select fill (whether imported from offsite or is already onsite) should consist of *uniform*, non-active inorganic lean clays with a PI between 10 and 20 percent, and more than 50 percent passing a No. 200 sieve. Material intended for use as select fill shall not have clay clods with PI greater than 20, clay clods greater than 2 inches in diameter, or contain sands/silts with PI less than 10. Sand and clay mixtures/blends are unacceptable for use as select fill. Sand/silt with clay clods is unacceptable for use as select fill. Mixing sand into clay or mixing clay into sand/silt is also unacceptable for use as select fill. **Prior to construction, the Contractor should determine if they can obtain qualified select fill meeting the above select fill criteria. The testing lab shall *reject* any material intended for use as select fill that does not meet the PI, sieve, and clay clod requirements above, unless approved otherwise by AEC.**

Lifts and Compaction: All material intended for use as select fill should be tested prior to use to confirm that it meets select fill criteria. The fill should be placed in loose lifts not exceeding 8 inches in thickness. Backfill within 3 feet of walls or columns should be placed in loose lifts no more than 4-inches thick and compacted using hand tampers, or small self-propelled compactors.

Select fill should be compacted to a minimum of 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

Testing: **If select fill will be used, at least one Atterberg Limits and one percent passing a No. 200 sieve test shall be performed for each 10,000 square feet (sf) of placed fill, per lift (with a minimum of one set of test per lift), to determine whether it meets select fill requirements.** Prior to placement of pavement or concrete, the moisture contents of the top 2 lifts of compacted select fill shall be re-tested (if there is an extended period of time between fill placement and concrete placement) to determine if the in-place moisture content of the lifts have been maintained at the required moisture requirements.

5.4.3 General Clay Fill

General clay fill can be used beneath structural floor slabs or for fill areas that will not support proposed or future structures, such as for mass site grading. AEC recommends that general clay fill consist of a clean, cohesive soil (USCS Classification “CL” or “CH”). Granular soils (i.e. sands, silts, and gravel; not more than 50 percent retained on No. 200 sieve) should not be used as general fill.

General clay fill should be placed in loose lifts not exceeding 8 inches in thickness. The fill should be compacted to 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation and Grading

To mitigate site problems that may develop following prolonged periods of rainfall, it is essential to have adequate drainage to maintain a relatively dry and firm surface prior to starting any work at the site. Adequate drainage should be maintained throughout the construction period. Methods for controlling surface runoff and ponding include proper site grading, berm construction around exposed areas, and installation of sump pits with pumps.

6.2 Construction Monitoring

Site preparation and subgrade preparation should be monitored by qualified geotechnical professionals to check for compliance with project documents and changed conditions, if encountered. AEC should be allowed to review the design and construction plans and specifications prior to release to check that the geotechnical recommendations and design criteria presented herein are properly interpreted.

7.0 LIMITATIONS

The information contained in this report summarizes conditions found on the date the borings were drilled. The attached boring logs are a true representation of the soils encountered at the specific boring locations on the date of drilling. Reasonable variations from the subsurface information presented in this report should be anticipated. AEC should be notified immediately if conditions encountered during construction are significantly different from those presented in this report.

This investigation was performed using the standard level of care and diligence normally practiced by recognized geotechnical engineering firms in this area, presently performing similar services under similar circumstances. This report is intended to be used in its entirety. The report has been prepared exclusively for the project and location described in this report. If pertinent project details change or otherwise differ

from those described herein, AEC should be notified immediately and retained to evaluate the effect of the changes on the recommendations presented in this report and revise the recommendations if necessary. The scope of services does not include a fault investigation. The recommendations presented in this report should not be used for other structures located at this site or similar structures located elsewhere, without additional evaluation and/or investigation.

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APPENDIX A

Plate A-1	Vicinity Map
Plate A-2	Boring Location Plan
Plates A-3 to A-7	Boring Logs
Plate A-8	Key to Symbols
Plate A-9	Classification of Soils for Engineering Purposes
Plate A-10	Terms Used on Boring Logs
Plate A-11	ASTM & TXDOT Designation for Soil Laboratory Tests

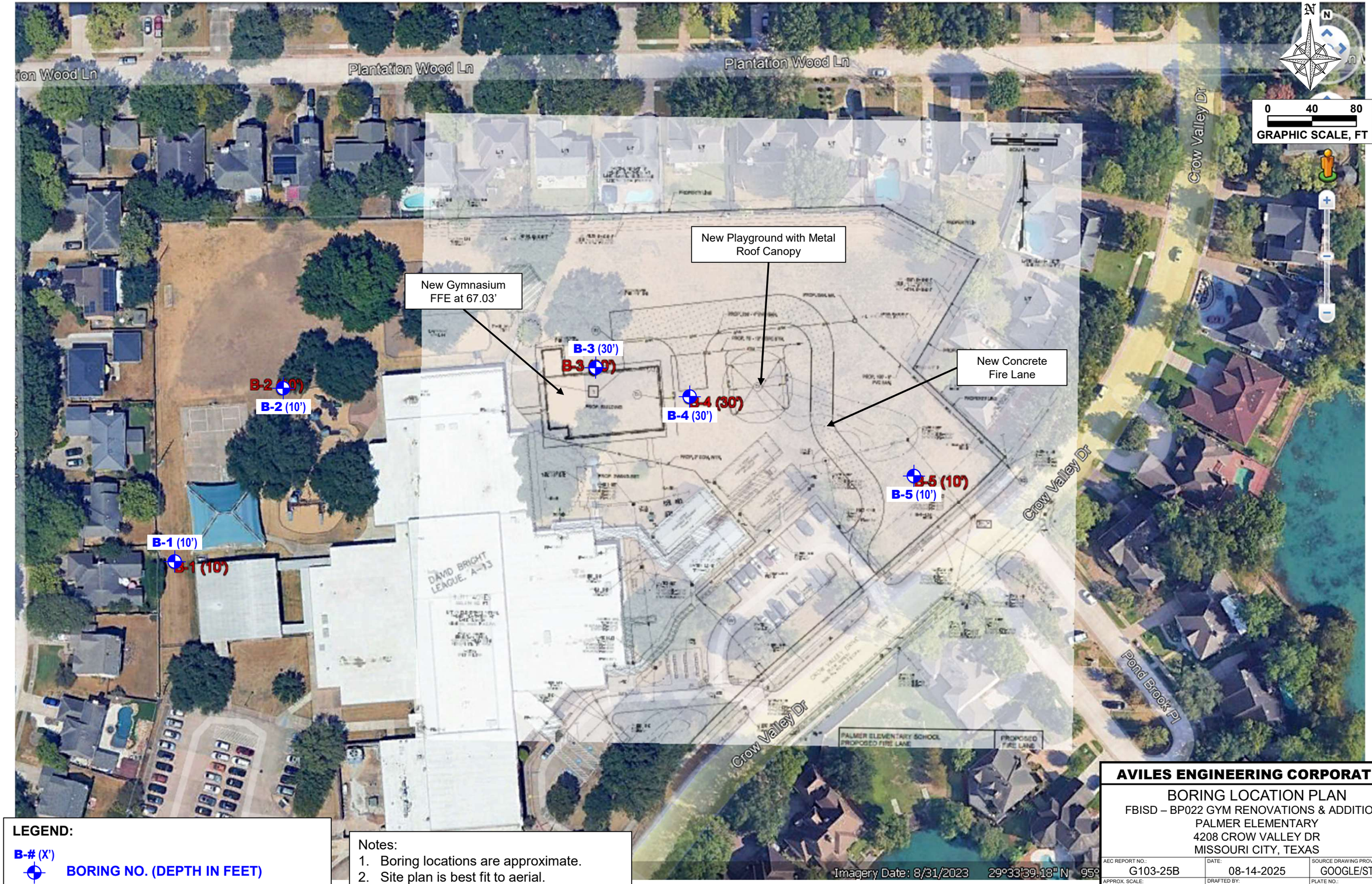


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VICINITY MAP

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
PALMER ELEMENTARY
4208 CROW VALLEY DR
MISSOURI CITY, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25B	05-01-2025	GOOGLE MAPS
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
N.T.S.	AN	PLATE A-1



LEGEND:

B-# (X') — **BORING NO. (DEPTH IN FEET)**

Notes:
1. Boring locations are approximate.
2. Site plan is best fit to aerial.

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BORING LOCATION PLAN

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
PALMER ELEMENTARY
4208 CROW VALLEY DR
MISSOURI CITY, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25B	08-14-2025	GOOGLE/STANTEC
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
1" = 80'	WLW	PLATE A-2

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Palmer Elementary School BORING B-1

DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5, 1, 1.5, 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 67.1								
0			Fill: hard, brown Sandy Lean Clay (CL), with fat clay pockets, calcareous nodules and roots		17			65.2	40	14	26
			Very stiff to hard, brown Fat Clay (CH), with slickensides		20						
5			-with silt seams 2'-4' -with lean clay pockets 4'-10'		20	105.3					
					25						
			-with silty sand seams 8'-10'		19						
10			Termination Depth = 10 feet								
15											
20											
25											
30											
35											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼

DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25B

PLATE A-3

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Palmer Elementary School BORING B-2

DATE 3/11/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 65.3								
			Hard, brown Fat Clay with Sand (CH), with silty sand pockets and roots		21			80.5	52	18	34
			Very stiff to hard, brown Lean Clay (CL), with fat clay and silt pockets		13	113.3					
5			Very stiff to hard, brown Fat Clay (CH) -with silt pockets 4'-6' -with silty sand seams 6'-10'		27						
					16						
					19						
10			Termination Depth = 10 feet								
15											
20											
25											
30											
35											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼

DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25B

PLATE A-4

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Palmer Elementary School BORING B-3

DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 66								
0			Very stiff to hard, brown Fat Clay (CH), with slickensides		21	101.4					
			-with calcareous nodules and roots 0'-2'								
			-with sandy lean clay pockets 2'-4'		23			89.2	58	20	38
5			Light brown, Clayey Sand (SC), with fat clay seams		8						
			Very loose to loose, brown Sandy Silt (ML)		7						
				4	11			61.7			
10			-with lean clay pockets 10'-12'	6	22						
				4	23						
15			Firm to very stiff, dark brown Fat Clay (CH), with silty clay seams	8	30						
			Loose, brown Silty Sand (SM), wet		24			29.6			
			-with roots and lean clay seams 16'-18'	7	22						
20											
			-with lean clay seams 23'-30'	5	24						
25											
				7	23						
30			Termination Depth = 30 feet								
35											

BORING DRILLED TO **30** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **14** FEET WHILE DRILLING ▽

WATER LEVEL AT **14** FEET AFTER **15 Mins** ▽

DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25B

PLATE A-5

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Palmer Elementary School BORING B-4

DATE 3/10/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0	Approximate Surface Elevation (feet): 65.5							
0	Stiff to hard, reddish brown Fat Clay (CH), with slickensides		30	90.8				
			29		98.5	68	22	46
5	-with calcareous nodules 4'-6'		26					
			29					
			22		96.6	58	18	40
10	Reddish brown, Sandy Silt (ML) -with lean clay seams 10'-12'		22	104.0				
			15		53.7	NP	NP	NP
15	Firm to stiff, reddish brown Lean Clay (CL)		25					
	Firm to stiff, reddish brown Fat Clay (CH), with sandy lean clay seams		25					
	Very loose, reddish brown Clayey Sand (SC)		24					
20								
25		WOH	22		40.7			
			22					
30	Termination Depth = 30 feet							
35								

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **30** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽
WATER LEVEL AT **N/A** FEET AFTER **Complete** ▽
DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25B

PLATE A-6

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Palmer Elementary School BORING B-5

DATE 3/11/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 65								
			Hard, reddish brown Fat Clay with Sand (CH), with slickensides -with calcareous nodules 0'-2'		24			80.4	52	16	36
					26						
5			-reddish brown and black 4'-6'		24	94.1					
			-with silt pockets 6'-8' and calcareous nodules 6'-10'		24						
					22						
10			Termination Depth = 10 feet								
15											
20											
25											
30											
35											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **Complete** ▼

DRILLED BY **ACE** DRAFTED BY **AN** LOGGED BY **BW**

PROJECT NO. G103-25B

PLATE A-7

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Fill
	High plasticity clay
	Low plasticity clay
	Clayey sand
	Silt
	Silty sand
Misc. Symbols	
○	Pocket Penetrometer
●	Unconfined Compression
▽	Water table depth during drilling
▼	Subsequent water table depth
□	Torvane
△	Confined Compression
Soil Samplers	
■	Undisturbed thin wall Shelby tube
⊠	Standard penetration test

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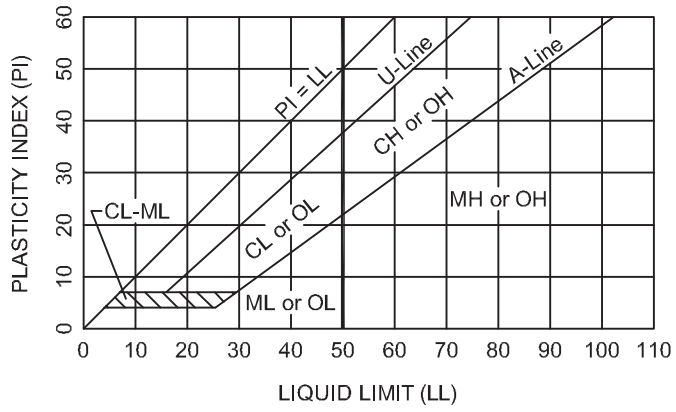
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487

MAJOR DIVISIONS				GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (Less than 50% of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well-graded gravel, well-graded gravel with sand
				GP	Poorly-graded gravel, poorly-graded gravel with sand
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	GM	Silty gravel, silty gravel with sand
			Limits plot above "A" line & hatched zone on plasticity chart	GC	Clayey gravel, clayey gravel with sand
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well-graded sand, well-graded sand with gravel
				SP	Poorly-graded sand, poorly-graded sand with gravel
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	SM	Silty sand, silty sand with gravel
			Limits plot above "A" line & hatched zone on plasticity chart	SC	Clayey sand, clayey sand with gravel
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)		SILTS AND CLAYS (Liquid Limit Less Than 50%)		ML	Silt, silt with sand, silt with gravel, sandy silt, gravelly silt
				CL	Lean clay, lean clay with sand, lean clay with gravel, sandy lean clay, gravelly lean clay
				OL	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt
		SILTS AND CLAYS (Liquid Limit 50% or More)		MH	Elastic silt, elastic silt with sand, sandy elastic silt, gravelly elastic silt
				CH	Fat clay, fat clay with sand, fat clay with gravel, sandy fat clay, gravelly fat clay
				OH	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt

NOTE: Coarse soils between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone of the plasticity chart are to have dual symbols.

PLASTICITY CHART



Equation of A-Line: Horizontal at PI=4 to LL=25.5, then PI=0.73(LL-20)

Equation of U-Line: Vertical at LL=16 to PI=7, then PI=0.9(LL-8)

DEGREE OF PLASTICITY OF COHESIVE SOILS

Degree of Plasticity	Plasticity Index
None	0 - 4
Slight	5 - 10
Medium	11 - 20
High	21 - 40
Very High	>40

SOIL SYMBOLS

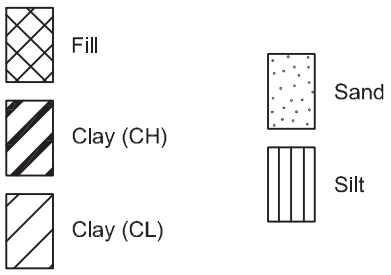


PLATE A-9

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TERMS USED ON BORING LOGS

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

6"	3"	3/4"	#4	#10	#40	#200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, Kips per Sq. ft.	SPT Blowcount
Very Soft	less than 0.25	< 2 bpf
Soft	0.25 to 0.50	2-4 bpf
Firm	0.50 to 1.00	4-8 bpf
Stiff	1.00 to 2.00	8-16 bpf
Very Stiff	2.00 to 4.00	16-32 bpf
Hard	greater than 4.00	>32 bpf

RELATIVE DENSITY OF COHESIONLESS SOILS FROM STANDARD PENETRATION TEST

Very Loose	<4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	>50 bpf

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows per Foot	Description
25	25 blows driving sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows driving sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows driving sampler 3 inches, during initial 6-inches seating interval.

NOTE: To avoid change to sampling tools, driving is limited to 50 blows during or after seating interval.

DRY STRENGTH ASTM D2488

None	Dry specimen crumbles into powder with mere pressure of handling
Low	Dry specimen crumbles into powder with some finger pressure
Medium	Dry specimen breaks into pieces or crumbles with considerable pressure
High	Dry specimen cannot be broken with finger pressure, it can be broken between thumb and hard surface
Very High	Dry specimen cannot be broken between thumb and hard surface

MOISTURE CONDITION ASTM D2488

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the easiness of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Friable	Crumbly, can be easily crushed with light pressure.
Blocky	Clays that have a block-like or polyhedral structure.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of calcium material.

ASTM & TXDOT DESIGNATION FOR SOIL LABORATORY TESTS

SOIL TEST	ASTM TEST DESIGNATION	TXDOT TEST DESIGNATION
Unified Soil Classification System	D 2487	Tex-142-E
Moisture Content	D 2216	Tex-103-E
Specific Gravity	D 854	Tex-108-E
Sieve Analysis	D 6913	Tex-110-E (Part 1)
Hydrometer Analysis	D 7928	Tex-110-E (Part 2)
Minus No. 200 Sieve	D 1140	Tex-111-E
Liquid Limit	D 4318	Tex-104-E
Plastic Limit	D 4318	Tex-105-E
Standard Proctor Compaction	D 698	Tex-114-E
Modified Proctor Compaction	D 1557	Tex-113-E
California Bearing Ratio	D 1883	-
Swell	D 4546	-
Consolidation	D 2435	-
Unconfined Compression	D 2166	-
Unconsolidated-Undrained Triaxial	D 2850	Tex-118-E
Consolidated-Undrained Triaxial	D 4767	Tex-131-E
Permeability (constant head)	D 5084	-
Pinhole	D 4647	-
Crumb	D 6572	-
Double Hydrometer	D 4221	-
pH of Soil	D 4972	Tex-128-E
Soil Suction	D 5298	-
Soil Sulfate	C 1580	Tex-145-E
Organics	D 2974	Tex-148-E

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APPENDIX B

Plate B-1 LPile Parameters for Canopy Foundations

Table 1. Drilled and Underreamed Footing LPile Parameters
Canopy Addition (Based on Boring B-4)

Depth (ft)	LPile Soil Type	γ (pcf)	γ' (pcf)	C_u (psf)	φ_u (deg.)	ε_{50}	k (pci)
0 to 3	Soft Clay (Matlock)	118	58	200	0	0.02	20
3 to 8	Stiff Clay without Free Water (Reese)	120	60	1,800	0	0.007	210
8 to 10	Stiff Clay without Free Water (Reese)	125	65	3,000	0	0.005	450

Notes: (1) γ = wet unit weight of soil, γ' = buoyant unit weight of soil.
(2) C_u = cohesion, ϕ_u = angle of internal friction.
(3) ε_{50} = strain at 50% of maximum stress, k = cyclic soil modulus for soil.
(4) Top 3 feet of soils in each boring are conservatively modeled as 'weak' soil, either very loose sand or very soft clay, regardless of actual soil condition.
(5) Groundwater was not encountered in boring.

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
ROSA PARKS ELEMENTARY SCHOOL
19101 CHIMNEY ROCK ROAD
FRESNO, TEXAS

Prepared for:
Fort Bend Independent School District
Missouri City, Texas

by

Aviles Engineering Corporation
5790 Windfern
Houston, Texas 77041
713-895-7645

REPORT NO. G103-25C (Final)

July 2025

AVILES
ENGINEERING CORP.

July 18, 2025

Ms. Nancy Lane
Fort Bend Independent School District
2323 Texas Parkway
Missouri City, Texas 77489

Reference: **Geotechnical Investigation**
Fort Bend Independent School District
BP022 - Gym Renovations and Additions
Rosa Parks Elementary School
Fresno, Texas
AEC Report No.: G103-25C (Final)

Dear Ms. Lane,

Aviles Engineering Corporation (AEC) is pleased to present this report of the results of our geotechnical investigation for the above referenced project. The project terms and conditions were performed in accordance with the Master Agreement for Professional Services between Fort Bend Independent School District (FBISD) and AEC, dated August 21, 2023. The project scope of services is in accordance with AEC Proposal No. G2024-12-01R1, dated January 10, 2025.

AEC appreciates the opportunity to be of service to you. Please call us if you have any questions or comments concerning this report or when we can be of further assistance.

Respectfully submitted,
Aviles Engineering Corporation
(TBPELS Firm Registration No. F-42)

STATE OF TEXAS
WILBER L. WANG
99226
LICENSED
PROFESSIONAL ENGINEER

7/8/ 2025

Wilber L. Wang, P.E.
Senior Engineer

Athira Nair, EIT
Staff Engineer

Reports Submitted: 1 Fort Bend Independent School District (electronic)
1 File (electronic)

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APPENDICES

APPENDIX A

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APPENDIX B

Plates B-1 and B-2	LPile Parameters for Canopy Foundations

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GEOTECHNICAL INVESTIGATION

FORT BEND INDEPENDENT SCHOOL DISTRICT
BP022 - GYM RENOVATIONS AND ADDITIONS
ROSA PARKS ELEMENTARY SCHOOL
19101 CHIMNEY ROCK ROAD
FRESNO, TEXAS

1.0 INTRODUCTION

1.1 General

The report submitted herein presents the results of Aviles Engineering Corporation's (AEC) geotechnical investigation for Rosa Parks Elementary School Gymnasium Renovations and Additions project, located at 19101 Chimney Rock Road, in Fresno, Texas, as part of the Fort Bend Independent School District (FBISD) 2023 Bond Program (FBISD Project No. BP022). A vicinity map of the project location is presented on Plate A-1, in Appendix A. AEC notes that the overall scope of the FBISD 2023 Bond Program (BP022) includes gym renovations and additions at three elementary schools: Hunter Glen Elementary School, Palmer Elementary School, and Rosa Parks Elementary School. This report, AEC Report No. G103-25C, presents recommendations for Rosa Parks Elementary School only. Recommendations for the remaining elementary schools are presented in AEC Reports G103-25A and G103-25B, respectively.

1.2 Purpose and Scope

Based on the 50 percent CD Submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a new playground with a metal canopy structure at the northeast side of the existing school, and the addition of a metal canopy structure to the existing playground at the southeast side of the existing school.

The purpose of this geotechnical investigation is to evaluate the subsurface soil and groundwater conditions at the project site and develop geotechnical engineering recommendations for the proposed improvements. The scope of this geotechnical investigation is summarized below:

1. Drilling and sampling two geotechnical borings to 30 feet below existing grade.
2. Soil Laboratory testing on selected soil samples.

3. Engineering analysis and recommendations for the canopies, including foundation type, bearing depth, allowable bearing capacity, uplift capacity, and LPile parameters.
4. Construction recommendations for the proposed improvements.

2.0 SUBSURFACE EXPLORATION

2.1 Soil Boring

The boring locations and depths at the project site were selected and provided by Stantec prior to drilling. The boring locations were staked in the field by AEC personnel using a handheld GPS unit. AEC drilled two borings (Boring B-1 and B-2) at the project site each to 30 feet below existing grade. The total drilling footage is 60 feet. Boring locations were not surveyed after completion of drilling. The approximate boring locations are shown on the Boring Location Plan on Plate A-2, in Appendix A. AEC estimated boring elevations (which are included on the boring logs) based on the grading plan in the provided drawings.

2.2 Drilling and Sampling Methods

Borings B-1 and B-2 were drilled using a truck-mounted drilling rig and were advanced using dry auger method. Undisturbed samples of cohesive soils and some disturbed samples of granular soils were obtained from the boring by pushing 3-inch diameter thin-wall, seamless steel Shelby tube samplers in general accordance with ASTM D 1587. Cohesionless soils were sampled with a 2-inch split-barrel sampler in accordance with ASTM D 1586. Standard Penetration Test resistance (N) values for these samples were recorded as “Blows per Foot” and are shown on the boring logs. Strength of the cohesive soils was estimated in the field using a hand penetrometer. The undisturbed samples of cohesive soils were extruded mechanically from the tube samplers in the field and wrapped in aluminum foil; all soil samples were sealed in plastic bags to reduce moisture loss and disturbance. The samples were then placed in core boxes and transported to the AEC laboratory for testing and further study. Groundwater readings were obtained during drilling and at completion of drilling. The boreholes were backfilled with bentonite chips upon completion of drilling.

3.0 LABORATORY TESTING PROGRAM

Soil laboratory testing was performed by AEC personnel. Samples from the borings were examined and classified in the laboratory by a technician under the supervision of a geotechnical engineer. Laboratory

tests were performed on selected soil samples to evaluate the engineering properties of the subsurface soils in accordance with applicable ASTM Standards. Atterberg limits, moisture contents, percent passing a No. 200 sieve, and dry unit weight tests were performed on selected samples to establish the index properties and confirm field classification of the subsurface soils. Strength properties of cohesive soils were determined by means of unconfined compression (UC) and unconsolidated-undrained (UU) triaxial tests performed on undisturbed samples. The laboratory test results are presented on the representative boring logs (see Plates A-3 and A-4, in Appendix A). A key to the boring logs, classification of soils for engineering purposes, terms used on boring logs, and reference ASTM Standards for laboratory testing are presented on Plates A-5 through A-8, in Appendix A.

4.0 SITE CONDITIONS

4.1 Subsurface Conditions

Details of the soils encountered during drilling are presented in the boring logs on Plates A-3 and A-4, in Appendix A. Soil strata encountered in the borings are summarized below.

Boring	Depth (ft)	Description of Stratum
B-1	0 - 16	Stiff to hard Fat Clay (CH), with slickensides
	16 - 30	Loose to medium dense, Poorly Graded Sand with Silt (SP-SM)
B-2	0 - 12	Stiff to hard Fat Clay (CH), with slickensides
	12 - 30	Loose to medium dense, Silty Sand (SM)

Soil Types and Expansive Potential: The subsurface soils encountered in the borings have high to very high plasticity (see "Degree of Plasticity of Cohesive Soils" on Plate A-6, in Appendix A), with a liquid limit (LL) ranging from 56 to 73, and a plasticity index (PI) ranging from 38 to 51. The cohesive soils encountered are classified as "CH" type and the granular soils encountered are classified as "SM", and "SP-SM" type soils in accordance with ASTM D 2487. "CH" soils undergo significant volume changes due to seasonal changes in soil moisture contents. Slickensides were encountered in the fat clay (CH) soils.

Groundwater Conditions: A summary of groundwater levels and boring cave-in depths encountered in the borings during drilling and at completion of drilling is presented in Table 1. The information in this report summarizes conditions found on the date the borings were drilled. However, it should be noted that our

groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress.

Table 1. Groundwater Levels and Cave-in Depths in Borings

Boring No.	Date Drilled	Boring Depth (ft)	Boring Groundwater Depth (ft)	Boring Cave-in Depth (ft)
B-1	2/27/2025	30	17 (Drilling) 16 (15 Mins.) 11.5 (Complete)	13 (Complete)
B-2	2/27/2025	30	14 (Drilling) 13 (15 Mins.) 12.7 (Complete)	12.7 (Complete)

4.2 Hazardous Materials

No signs of visual staining or odors were encountered during field drilling or during processing of the soil samples in the laboratory. However, AEC notes that the presence of potential hazardous material at other locations within the project area cannot be discounted based upon the very small and limited number of samples taken.

4.3 Subsurface Variations

It should be emphasized that: (i) at any given time, groundwater depths can vary from location to location, and (ii) at any given location, groundwater depths can change with time. Groundwater depths will vary with seasonal rainfall and other climatic/environmental events. It should be noted that the division of soil strata presented herein is based on available data and interpretations at the time of investigation. Subsurface conditions may vary away from the boring location.

Clay soils in the Greater Houston area typically have secondary features such as slickensides, calcareous and ferrous nodules, and contain sand/silt seams/lenses/layers/pockets. It should be noted that the information in the boring logs is based on 3-inch or 2-inch diameter soil samples. Soil samples were obtained in borings continuously at intervals of 2 feet from the ground surface to a depth of 20 feet below grade, and then at 5 foot intervals thereafter to the boring termination depth of 30 feet. A detailed description of the soil secondary features may not have been obtained due to the small sample size and

sampling interval between the samples. Therefore, while a boring log shows some soil secondary features, it should not be assumed that the features are absent where not indicated on the boring log.

5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Based on the 50 percent CD Submission drawings (dated June 20, 2025) prepared by Stantec, the proposed improvements include the construction of a new playground with a metal canopy structure at the northeast side of the existing school, and the addition of a metal canopy structure to the existing playground at the southeast side of the existing school.

Construction Specifications: AEC is not aware if there are specific construction specifications for FBISD projects. For this report, AEC has instead referred to City of Houston Standard Construction Specifications (COHSCS). AEC should be notified if different construction specifications should be used.

5.1 Canopy Addition

Based on Boring B-1, the soil conditions at the southeast canopy addition generally consist of stiff to hard fat clay (CH) from the ground surface to a depth of 16 feet, followed by loose to medium dense poorly graded sand with silt (SP-SM) to a depth of 20 feet. Based on Boring B-2, the soil conditions at the northeast canopy addition consist of stiff to hard fat clay (CH) from the ground surface to a depth of 12 feet, underlain by loose to medium dense silty sand (SM) to a depth of 20 feet.

Based on the soil condition encountered, AEC recommends that the canopies be supported on drilled and underreamed footings founded at least 10 feet below existing grade. AEC assumes that 10 foot deep drilled and underreamed footings should be able to provide sufficient resistance against axial, lateral, and uplift loading from the canopies. If additional lateral and/or uplift resistance is required, then the founding depth of the drilled and underreamed footings can be increased. In that case, AEC does not recommend the underreamed foundations exceed 16 feet depth for the southeast canopy and 12 feet depth at the northeast canopy due to the presence of granular soils at these depths. If the required lateral and uplift load resistances still cannot be achieved with a drilled and underreamed footing, a longer straight sided drilled shaft may be needed instead. AEC will provide straight sided drilled shaft recommendations if needed.

For both canopies, drilled and underreamed footings founded at a depth of approximately 10 feet below existing grade [i.e. bearing at an elevation of approximately 61 feet Mean Sea Level (MSL)] should be designed for an allowable bearing capacity of 3,600 pounds per square foot (psf) for sustained loads and an allowable bearing capacity of 5,400 psf for total loads. The allowable bearing capacities provided include a factor of safety (FS) of 3 for sustained loads and a FS of 2 for total loads. Whichever net allowable bearing capacity results in a larger footing diameter (at the selected footing depth) should be used for design.

Uplift Capacity: According to O'Neill and Reese (1999), "Drilled Shafts: Construction Procedures and Design Methods", the uplift resistance of a drilled and underreamed footing in cohesive soils can be calculated as:

$$Q\ (uplift) = (s_u\ N_u\ A_u)/FS_1 + W_c/FS_2 + W_s/FS_3 \quad \text{.....Equation (1)}$$

$$N_u = 1.5\ D_b / B_b \ \leq 9 \quad \text{.....Equation (2)}$$

where:

	Q	=	Allowable uplift resistance of a drilled footing, lbs
	s_u	=	Average undrained shear strength of the cohesive soil between the base of the bell and 2 B_b above the base; use s_u = 1,150 psf, based on Borings B-1 and B-2
	N_u	=	Bearing capacity factor for base uplift resistance, $N_u \leq 9$
	D_b	=	Depth of base below ground surface minus the seasonal moisture change zone for a drilled and underreamed footing, ft; the seasonal moisture change zone in Houston can be considered as 10 feet below the existing ground surface
	B_b	=	Diameter of the bell, ft
	B_s	=	Diameter of the shaft, ft
	W_c	=	Effective weight of concrete footing, lbs
	W_s	=	Effective weight of projected soil above the bell, lbs (use unit weight, γ = 120 pcf for soils above water table, and buoyant unit weight γ' = 60 pcf for soils below water table)
	A_u	=	$\pi/4\ (B_b^2 - B_s^2)$, projected area of bell over shaft, ft^2
	FS_1, FS_2, FS_3	=	Factors of Safety for uplift resistance

AEC recommends that the following FS be used for uplift design: FS of 2 for soil cohesion (FS_1 = 2), FS of 1.1 for dead weight of footing (FS_2 = 1.1), and FS of 1.5 for weight of soil above the bell (FS_3= 1.5). If the calculated uplift resistance of the foundation does not meet the uplift loading requirements, the depth of the underream can be increased to a maximum of 16 feet for the southeast canopy and 12 feet of the northeast canopy. If the increased underream depth is still insufficient, AEC recommends that a straight drilled shaft be used instead. AEC will provide straight sided drilled shaft recommendations if necessary.

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LPile Soil Parameters: Design LPile soil parameters that can be used for foundation lateral load design are presented on Plates B-1 and B-2, in Appendix B. For the LPile parameters, AEC conservatively considered the top 3 feet of soil of the borings to be weak soil (either soft clay or very loose sand, regardless of its actual soil condition), to account for potential desiccation and shrinkage of the near surface clays or disturbance caused by construction. In a similar manner to the uplift load resistance, AEC should be notified if additional lateral load resistance will be required for the canopy foundations. If so, AEC recommends that straight sided drilled shafts be used instead of drilled and underreamed footings. The shaft lengths should be increased as necessary to provide additional lateral resistance. AEC will provide straight sided drilled shaft recommendations if necessary.

Vertical Reinforcing Steel: To withstand tensile forces resulting from the shrink/swell movements of clay soils in the moisture active zone, each footing should be designed to contain reinforcing steel throughout its full length sufficient to resist a tensile load of at least 45d kips, where "d" is the diameter of the shaft in feet.

Footing Spacing: To reduce stress overlap from adjacent footings and potential construction problems, the minimum edge-to-edge clear spacing between the underreams should not be less than 0.6 x diameter of the larger underream.

Footing Settlements: A detailed settlement analysis is beyond the scope of this investigation. However, based on the soil conditions encountered and the anticipated structural loads, we estimate that drilled-and-underreamed footings, designed and constructed as recommended in this report, will experience total settlements on the order of 1 inch.

Drilled-and-Underreamed Footing Construction: Drilled-and-underreamed footings should be constructed in accordance with Section 02465 of the latest edition of the City of Houston Standard Construction Specifications (COHSCS). A qualified geotechnical technician should check each footing excavation prior to placing concrete to ensure that:

1) The footing has been constructed to the specified dimensions at the recommended depth and founded in the correct formation as indicated in this report;
2) The column is concentric with the pier cap/grade beam and drilled footing; and
3) Excessive cuttings, any soft or compressible materials, and ponded water are removed from the bottom of the excavation.

There is a possibility that slickensides and/or pockets/seams of sands/silts within the clay soils may make underreaming (belling) difficult and result in potential sloughing or caving-in of the shaft excavation sidewalls during construction, particularly for underreams over 6 feet in diameter. We recommend that a maximum diameter ratio of bell to shaft not exceed 2 to 1.

Based on Borings B-1 and B-2, drilled and underreamed footing excavations that are 10 feet deep will encounter stiff to hard fat clay (CH). Based on the groundwater levels encountered in Borings B-1 and B-2 (refer to Table 1 in Section 4.1 of this report), AEC anticipates that the site groundwater level will remain below the anticipated foundation bearing depth of 10 feet. However, the site's groundwater level should be expected to fluctuate with seasonal rainfall and other climatic events and may be higher at the time of construction. If ground water is encountered within the cohesive soils during construction, sump pumps may be used to pump water out from the excavations and soft sediments should be removed. However, if significant sloughing or caving occurs during shaft excavation, further excavation should be stopped and a reduced bell/shaft ratio or even straight-sided shafts (matching the bell diameter) in combination with bentonite slurry and/or temporary casing may be necessary.

Placement of concrete should be accomplished immediately after excavation is completed to reduce potential for sloughing of the foundation soils. Footing excavations should not be left open overnight. No concrete should be placed without the prior approval of the Owner's Representative. New drilled footings should not be excavated within 2 bell diameters or 15 feet (edge to edge), whichever is larger, of an open footing excavation, or one in which concrete has been placed in the preceding 24 hours, to prevent movement of fresh concrete from the recently filled footing to an adjacent unfilled footing.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation and Grading

To mitigate site problems that may develop following prolonged periods of rainfall, it is essential to have adequate drainage to maintain a relatively dry and firm surface prior to starting any work at the site. Adequate drainage should be maintained throughout the construction period. Methods for controlling surface runoff and ponding include proper site grading, berm construction around exposed areas, and installation of sump pits with pumps.

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6.2 Construction Monitoring

Site preparation should be monitored by qualified geotechnical professionals to check for compliance with project documents and changed conditions, if encountered. AEC should be allowed to review the design and construction plans and specifications prior to release to check that the geotechnical recommendations and design criteria presented herein are properly interpreted.

7.0 LIMITATIONS

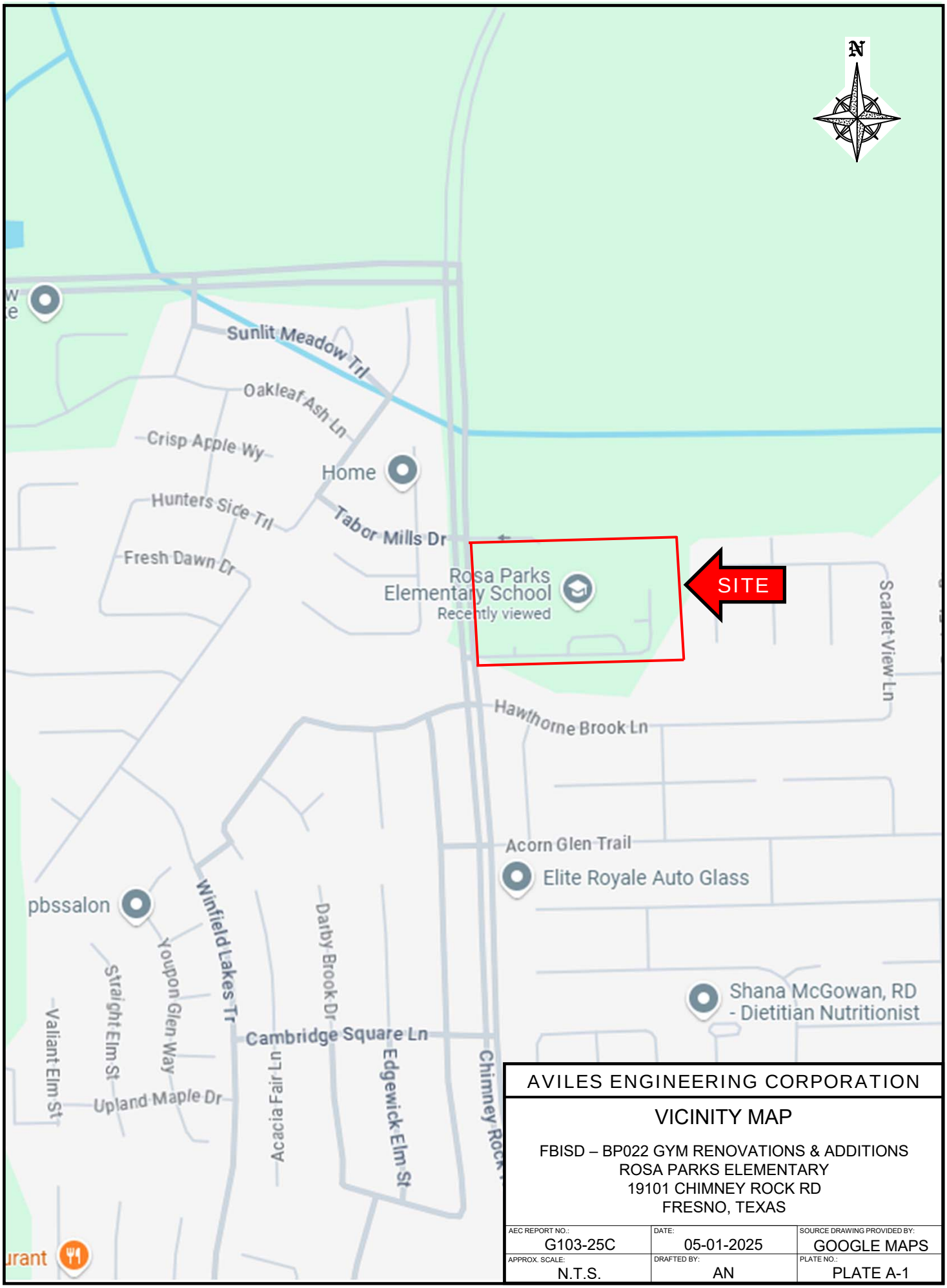
The information contained in this report summarizes conditions found on the date the boring was drilled. The attached boring log is a true representation of the soils encountered at the specific boring location on the date of drilling. Reasonable variations from the subsurface information presented in this report should be anticipated. AEC should be notified immediately if conditions encountered during construction are significantly different from those presented in this report.

This investigation was performed using the standard level of care and diligence normally practiced by recognized geotechnical engineering firms in this area, presently performing similar services under similar circumstances. This report is intended to be used in its entirety. The report has been prepared exclusively for the project and location described in this report. If pertinent project details change or otherwise differ from those described herein, AEC should be notified immediately and retained to evaluate the effect of the changes on the recommendations presented in this report and revise the recommendations if necessary. The scope of services does not include a fault investigation. The recommendations presented in this report should not be used for other structures located at this site or similar structures located elsewhere, without additional evaluation and/or investigation.

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APPENDIX A

Plate A-1	Vicinity Map
Plate A-2	Boring Location Plan
Plates A-3 and A-4	Boring Logs
Plate A-5	Key to Symbols
Plate A-6	Classification of Soils for Engineering Purposes
Plate A-7	Terms Used on Boring Logs
Plate A-8	ASTM & TXDOT Designation for Soil Laboratory Tests

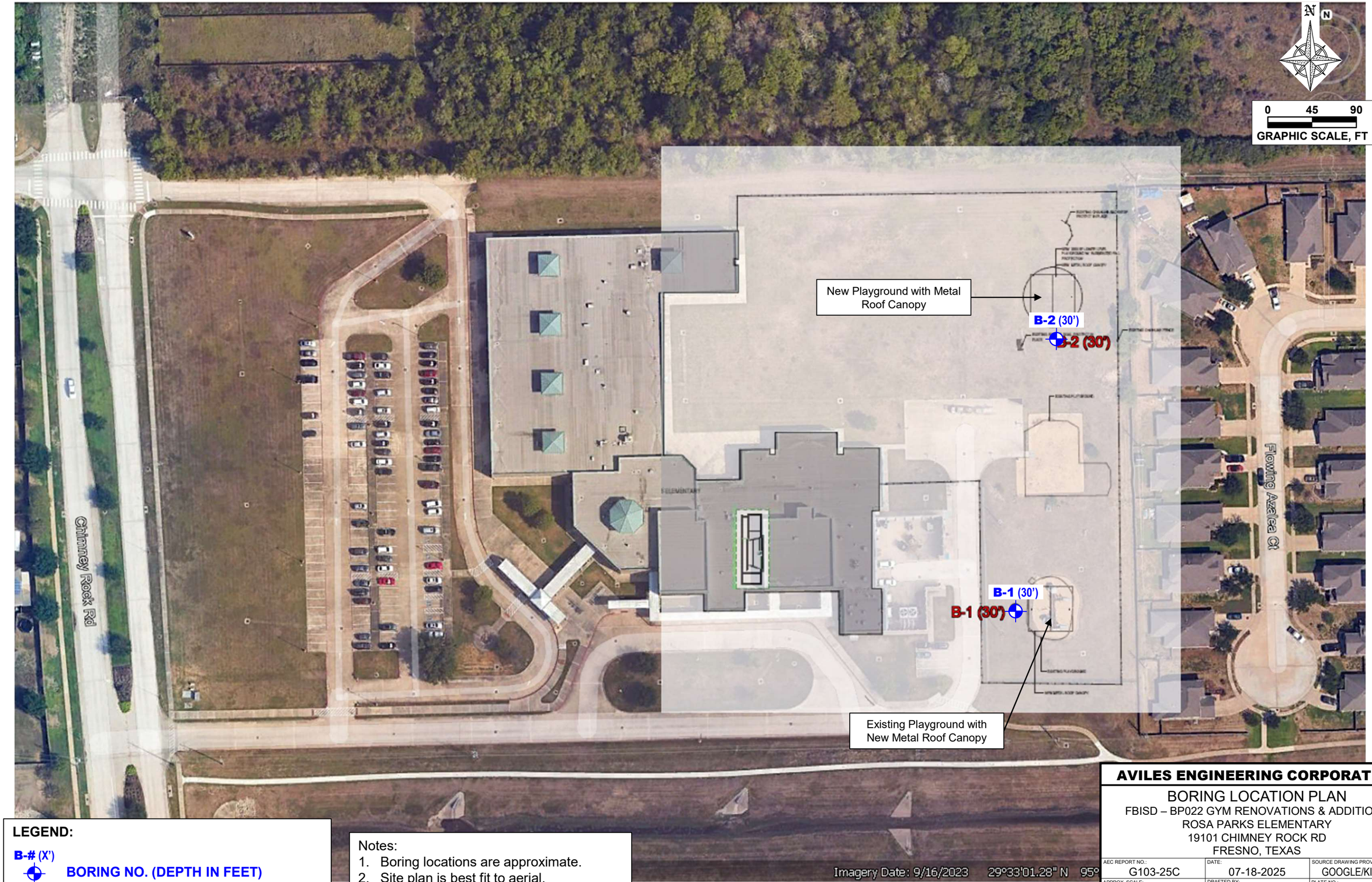


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VICINITY MAP

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
ROSA PARKS ELEMENTARY
19101 CHIMNEY ROCK RD
FRESNO, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25C	05-01-2025	GOOGLE MAPS
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
N.T.S.	AN	PLATE A-1



LEGEND:

B-# (X')

BORING NO. (DEPTH IN FEET)

Notes:
1. Boring locations are approximate.
2. Site plan is best fit to aerial.

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BORING LOCATION PLAN

FBISD – BP022 GYM RENOVATIONS & ADDITIONS
ROSA PARKS ELEMENTARY
19101 CHIMNEY ROCK RD
FRESNO, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G103-25C	07-18-2025	GOOGLE/KIRKSEY
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
1" = 90'	WLW	PLATE A-2

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Rosa Parks Elementary School BORING B-1

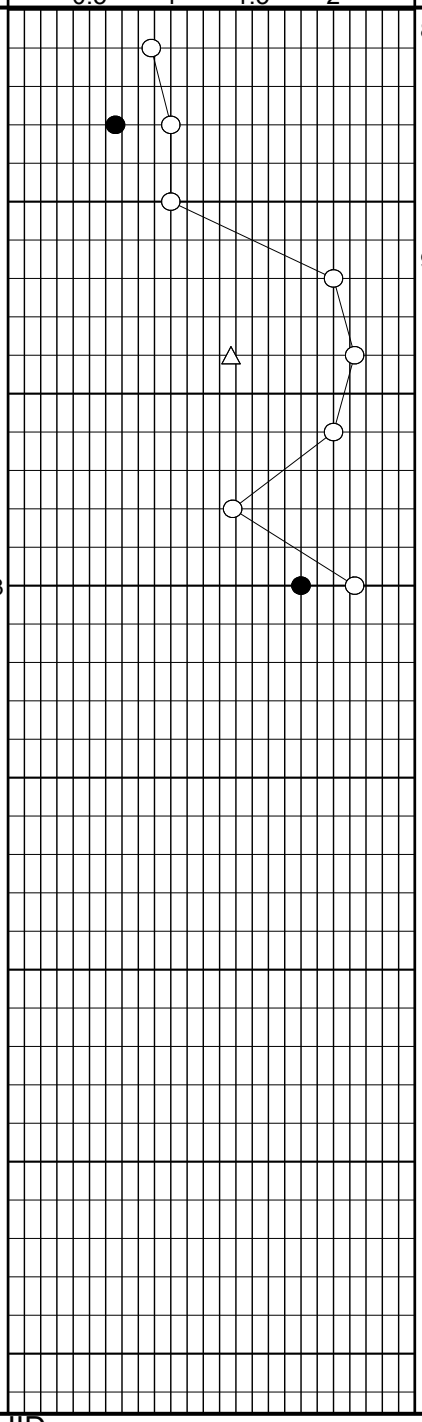
DATE 2/27/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	Approximate Surface Elevation (feet): 71							
0	Stiff to hard, gray Fat Clay (CH), with slickensides		27		86.5	63	18	45
	-with sand pockets 0'-2' and calcareous nodules 0'-6'		25	97.7				
5	-gray and tan 4'-6', with ferrous nodules 4'-8'		24					
	-reddish brown 6'-8'		28		99.1	73	22	51
	-light gray and reddish brown 8'-12'		26	98.4				
10	-with silty sand pockets 10'-12'		25					
	-reddish brown, with silt seams 12'-14' and calcareous nodules 12'-16'		24					
	-boring cave-in at 13' after completion of drilling							
15	-light gray and reddish brown 14'-16'		20	107.3				
	Loose to medium dense, tan Poorly Graded Sand with Silt (SP-SM), wet	6	21		5.3			
	-groundwater at 16' approximately 15 minutes after initial encounter	9	20					
20								
		24	19					
25								
		22	20					
30	Termination Depth = 30 feet							
35								

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2



BORING DRILLED TO **30** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **17** FEET WHILE DRILLING ▽
WATER LEVEL AT **11.5** FEET AFTER **Complete** ▽
DRILLED BY **GDT** DRAFTED BY **AN** LOGGED BY **AZ**

PROJECT NO. G103-25C

PLATE A-3

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: Rosa Parks Elementary School BORING B-2

DATE 2/27/2025 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 70.5				0.5 1 1.5 2				
0			Stiff to hard, dark gray Fat Clay (CH), with slickensides		26			86.7	56	18	38
					25	96.0					
5			-gray and brown, with calcareous and ferrous nodules 4'-6'		18						
			-gray and reddish brown 6'-8'		20						
			-reddish brown 8'-12', with silt seams 8'-10'		23			99.5	62	19	43
10			-with calcareous and ferrous nodules 10'-12'		23	102.6					
			Loose to medium dense, tan Silty Sand (SM), wet		23			35.2			
			-with lean clay pockets 12'-16'								
15			-boring cave-in at 12.7' after completion of drilling	7	23						
			-groundwater at 13' approximately 15 minutes after initial encounter	6	23						
				8	19						
20											
			-with lean clay pockets 23'-25'	10	23						
25											
				13	19						
30			Termination Depth = 30 feet								
35											

BORING DRILLED TO **30** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **14** FEET WHILE DRILLING ▽

WATER LEVEL AT **12.7** FEET AFTER **Complete** ▽

DRILLED BY **GDT** DRAFTED BY **AN** LOGGED BY **AZ**

PROJECT NO. G103-25C

PLATE A-4

KEY TO SYMBOLS

Symbol Description

Strata symbols



High plasticity clay



Poorly graded sand with silt



Silty sand

Misc. Symbols



Water table depth during drilling



Subsequent water table depth

○ **Pocket Penetrometer**

● **Unconfined Compression**

△ **Confined Compression**

Soil Samplers



Undisturbed thin wall Shelby tube



Standard penetration test

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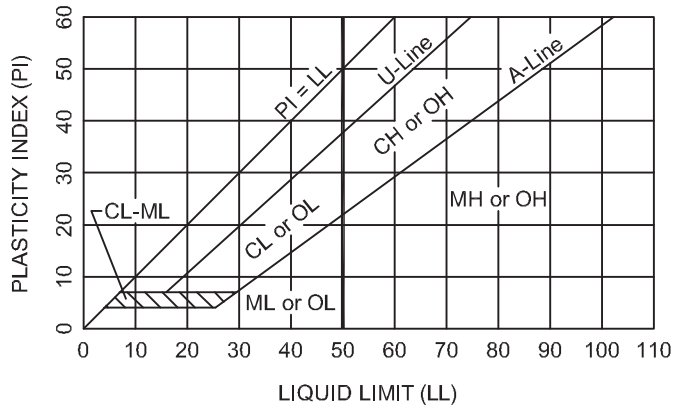
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487

MAJOR DIVISIONS				GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (Less than 50% of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well-graded gravel, well-graded gravel with sand
				GP	Poorly-graded gravel, poorly-graded gravel with sand
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	GM	Silty gravel, silty gravel with sand
			Limits plot above "A" line & hatched zone on plasticity chart	GC	Clayey gravel, clayey gravel with sand
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well-graded sand, well-graded sand with gravel
				SP	Poorly-graded sand, poorly-graded sand with gravel
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	SM	Silty sand, silty sand with gravel
			Limits plot above "A" line & hatched zone on plasticity chart	SC	Clayey sand, clayey sand with gravel
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)		SILTS AND CLAYS (Liquid Limit Less Than 50%)		ML	Silt, silt with sand, silt with gravel, sandy silt, gravelly silt
				CL	Lean clay, lean clay with sand, lean clay with gravel, sandy lean clay, gravelly lean clay
				OL	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt
		SILTS AND CLAYS (Liquid Limit 50% or More)		MH	Elastic silt, elastic silt with sand, sandy elastic silt, gravelly elastic silt
				CH	Fat clay, fat clay with sand, fat clay with gravel, sandy fat clay, gravelly fat clay
				OH	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt

NOTE: Coarse soils between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone of the plasticity chart are to have dual symbols.

PLASTICITY CHART



Equation of A-Line: Horizontal at PI=4 to LL=25.5, then PI=0.73(LL-20)

Equation of U-Line: Vertical at LL=16 to PI=7, then PI=0.9(LL-8)

DEGREE OF PLASTICITY OF COHESIVE SOILS

Degree of Plasticity	Plasticity Index
None	0 - 4
Slight	5 - 10
Medium	11 - 20
High	21 - 40
Very High	>40

SOIL SYMBOLS

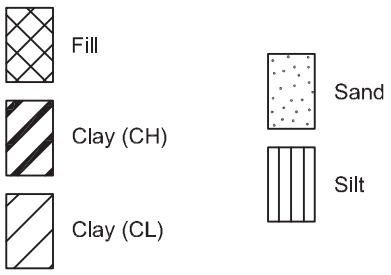


PLATE A-6

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TERMS USED ON BORING LOGS

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

6"	3"	3/4"	#4	#10	#40	#200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, Kips per Sq. ft.	SPT Blowcount
Very Soft	less than 0.25	< 2 bpf
Soft	0.25 to 0.50	2-4 bpf
Firm	0.50 to 1.00	4-8 bpf
Stiff	1.00 to 2.00	8-16 bpf
Very Stiff	2.00 to 4.00	16-32 bpf
Hard	greater than 4.00	>32 bpf

RELATIVE DENSITY OF COHESIONLESS SOILS FROM STANDARD PENETRATION TEST

Very Loose	<4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	>50 bpf

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows per Foot	Description
25	25 blows driving sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows driving sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows driving sampler 3 inches, during initial 6-inches seating interval.

NOTE: To avoid change to sampling tools, driving is limited to 50 blows during or after seating interval.

DRY STRENGTH ASTM D2488

None	Dry specimen crumbles into powder with mere pressure of handling
Low	Dry specimen crumbles into powder with some finger pressure
Medium	Dry specimen breaks into pieces or crumbles with considerable pressure
High	Dry specimen cannot be broken with finger pressure, it can be broken between thumb and hard surface
Very High	Dry specimen cannot be broken between thumb and hard surface

MOISTURE CONDITION ASTM D2488

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the easiness of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Friable	Crumbly, can be easily crushed with light pressure.
Blocky	Clays that have a block-like or polyhedral structure.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of calcium material.

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ASTM & TXDOT DESIGNATION FOR SOIL LABORATORY TESTS

SOIL TEST	ASTM TEST DESIGNATION	TXDOT TEST DESIGNATION
Unified Soil Classification System	D 2487	Tex-142-E
Moisture Content	D 2216	Tex-103-E
Specific Gravity	D 854	Tex-108-E
Sieve Analysis	D 6913	Tex-110-E (Part 1)
Hydrometer Analysis	D 7928	Tex-110-E (Part 2)
Minus No. 200 Sieve	D 1140	Tex-111-E
Liquid Limit	D 4318	Tex-104-E
Plastic Limit	D 4318	Tex-105-E
Standard Proctor Compaction	D 698	Tex-114-E
Modified Proctor Compaction	D 1557	Tex-113-E
California Bearing Ratio	D 1883	-
Swell	D 4546	-
Consolidation	D 2435	-
Unconfined Compression	D 2166	-
Unconsolidated-Undrained Triaxial	D 2850	Tex-118-E
Consolidated-Undrained Triaxial	D 4767	Tex-131-E
Permeability (constant head)	D 5084	-
Pinhole	D 4647	-
Crumb	D 6572	-
Double Hydrometer	D 4221	-
pH of Soil	D 4972	Tex-128-E
Soil Suction	D 5298	-
Soil Sulfate	C 1580	Tex-145-E
Organics	D 2974	Tex-148-E

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APPENDIX B

Plates B-1 and B-2 LPile Parameters for Canopy Foundations

Table 1. Drilled and Underreamed Footing LPile Parameters
Canopy Addition (Based on Boring B-1)

Depth (ft)	LPile Soil Type	γ (pcf)	γ' (pcf)	C_u (psf)	φ_u (deg.)	ε_{50}	k (pci)
0 to 3	Soft Clay (Matlock)	122	55	200	0	0.02	20
3 to 6	Stiff Clay without Free Water (Reese)	122	62	1,300	0	0.008	160
6 to 10	Stiff Clay without Free Water (Reese)	124	64	2,600	0	0.005	380

Notes: (1) γ = wet unit weight of soil, γ' = buoyant unit weight of soil.
(2) C_u = cohesion, ϕ_u = angle of internal friction.
(3) ε_{50} = strain at 50% of maximum stress, k = cyclic soil modulus for soil.
(4) Top 3 feet of soils in each boring are conservatively modeled as 'weak' soil, either very loose sand or very soft clay, regardless of actual soil condition.
(5) Highest groundwater at 11.5 feet.

Table 2. Drilled and Underreamed Footing LPile Parameters
Canopy Addition (Based on Boring B-2)

Depth (ft)	LPile Soil Type	γ (pcf)	γ' (pcf)	C_u (psf)	φ_u (deg.)	ε_{50}	k (pci)
0 to 3	Soft Clay (Matlock)	120	55	200	0	0.02	20
3 to 4	Stiff Clay without Free Water (Reese)	120	60	1,700	0	0.007	200
4 to 10	Stiff Clay without Free Water (Reese)	126	66	3,000	0	0.005	450

Notes: (1) γ = wet unit weight of soil, γ' = buoyant unit weight of soil.
(2) C_u = cohesion, ϕ_u = angle of internal friction.
(3) ε_{50} = strain at 50% of maximum stress, k = cyclic soil modulus for soil.
(4) Top 3 feet of soils in each boring are conservatively modeled as 'weak' soil, either very loose sand or very soft clay, regardless of actual soil condition.
(5) Highest groundwater at 12.7 feet.

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.

Init.
/

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

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.)

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[ ] 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.)

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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%)

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§ 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.)

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§ 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.

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§ 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.)

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[ ] 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)*

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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.

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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.)*~~

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...

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 .

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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)

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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.

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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.

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§ 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.

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§ 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.

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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

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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

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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

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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

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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,

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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

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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

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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.

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§ 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.

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§ 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,

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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.

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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.

§ 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

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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

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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,

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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.

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§ 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

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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

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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

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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.

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§ 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.

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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.

§ 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.

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§ 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.

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§ 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.

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.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

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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.

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.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

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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.

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§ 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

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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;

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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

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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.

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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 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

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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

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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.

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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

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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

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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.

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(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.

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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.

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§ 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.

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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.

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§ 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.

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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.

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.

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§ 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

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.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.

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§ 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)

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§ 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.

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General Conditions of the Contract for Construction

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(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

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.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

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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.

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§ 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.

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§ 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

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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'

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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

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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

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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.

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§ 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

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.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.

...

§ 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.

...

§ 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

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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~~

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~~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

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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

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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**

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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

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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

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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..

...

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~~§ 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

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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.

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§ 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.

...

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~~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

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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.~~

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~~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

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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

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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.

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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.

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§ 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.

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§ 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.~~

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~~**§ 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:

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.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

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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~~

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~~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.

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§ 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

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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.~~

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...

§ 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

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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.~~

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~~**§ 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.~~

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_____

(Signed)

_____

(Title)

_____

(Dated)

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FBISD
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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

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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:

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 10 00 Summary of Work

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. Addition/Renovation scope at four (4) ES Campuses.
   a. Hunters Glen ES: New Gym addition and associated MEP scope and site improvements, including relocation of existing swings. Renovation of existing Gym/ELP building. Interior renovations (paint, wall covering).
   b. Palmer ES: New Gym addition and associated MEP scope and site improvements, including improvements at Hardtop Play surface (Restriping, Shade Cover Renovations).
      Install new Lower-level Playground and provide metal roof canopy.
      Provide irrigation around the main building perimeter.
      Renovation of existing Gym/ELP building. Interior renovations (paint, floor + wall covering)
   c. Ridgegate ES: Renovation of existing Gym/ELP building to New Gymnasium space.
      Interior lighting and lighting controls upgrades at existing

building.
Interior renovations (paint, wall coverings) + (replace casework at select classrooms)

d. Rosa Parks ES: Install new Lower-level Playground and provide metal roof canopy at new and existing playgrounds. Provide irrigation around the main building perimeter.
Replace existing Stage Curtain.

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 14 13 Certification of Compliance / Contractor Identification

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.

.

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 _____

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 21 00 Allowances

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 22 00 Unit Prices

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 23 00 Alternates

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. **Alternate No. 1 Base Bid Adjustment**
   1. Include any adjustment to Base Bid.

B. **Alternate No. 2 Deviations Request Form**
   1. Include any substitutions or deviations from the Base Bid.

C. **Alternate No. 3A: Palmer ES - Metal Canopy at Playground**
   1. Provide new metal roof canopy for one playground. Scope to include canopy footings, downspout boots and storm utility tie-ins.

D. **Alternate No. 3B Palmer ES - Fabric Canopy at Hardtop Play Area**
   1. Replace fabric at existing shade cover at hardtop play area.

E. **Alternate No. 4 Rosa Parks ES - Stage Curtains**
   1. Replace all existing stage curtains at Rosa Parks Elementary School.

End of Section 01 23 00

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 25 00 Substitution Procedures

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 26 00 CONTRACT MODIFICATION PROCEDURES

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 29 00 Payment Procedures

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 29 73 Schedule of Values

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 31 00 Project Management and Coordination

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 31 13 Project Coordination

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 32 00 Construction Progress Documentation

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 32 16 Construction Progress Schedule

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 32 33 - Photographic Documentation

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 33 00 Submittal Procedures

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 35 23 Project Safety and Loss Prevention

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 40 00 Quality Requirements

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 42 00 References

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 45 23.01 HVAC Testing, Adjusting and Balancing

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 45 23.02 Testing and Inspection

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 50 00 Temporary Facilities and Controls

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 52 14 Temporary Facilities for Students

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.

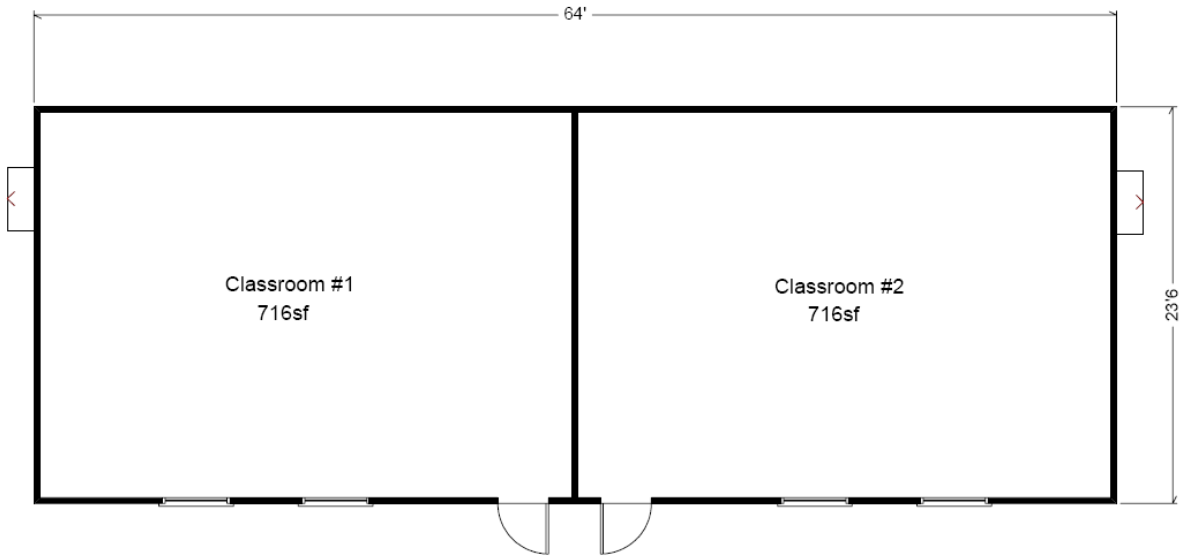
W. Hitch/Tires/Axles: Hitches will be removed and stored under building while tires and axles are to remain on the modules. Tires and axles will be removed only if necessary to complete the building installation due to site constraints and will also be placed under the modules.

1.5 Furniture, Fixtures, and Equipment (FF&E)

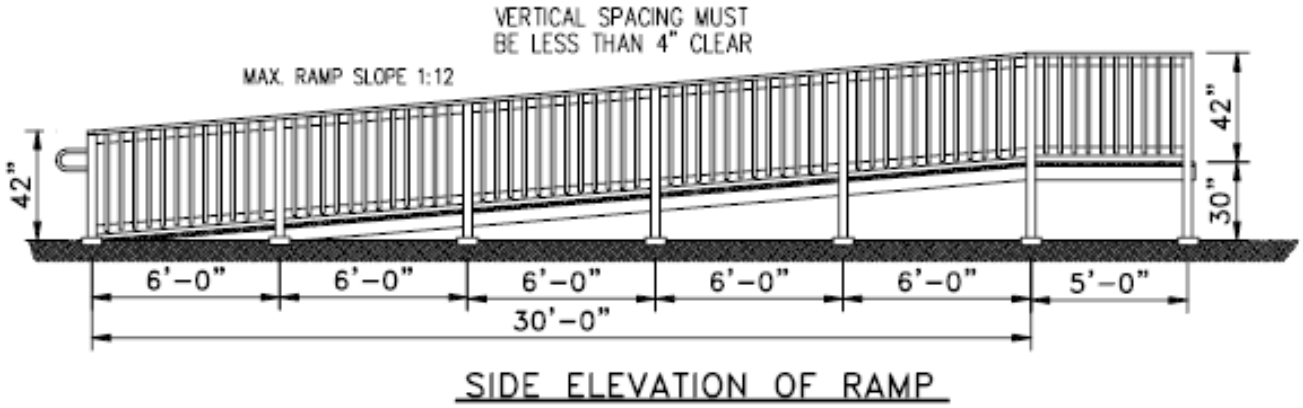
A. The Contractor shall furnish and set in place all FF&E items necessary for a functional classroom. The furniture may be provided by FBISD, but will be the full responsibility of the contractor to move to site and back to origin. These items should include, at a minimum: student desks and chairs, teacher 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

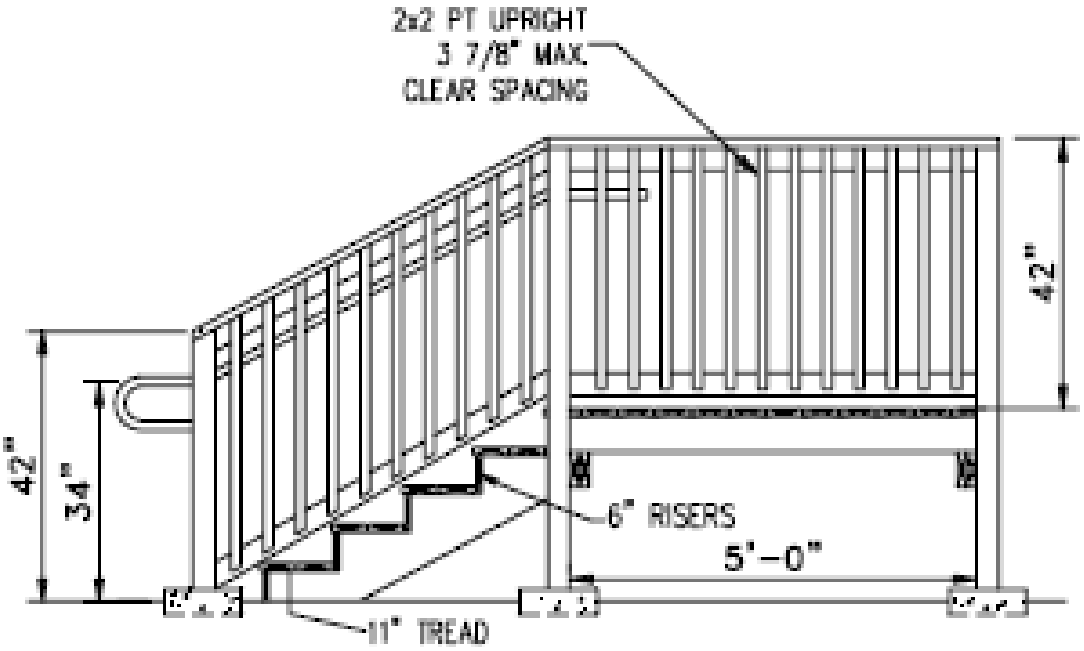
A. The following is a typical floor plan design guideline drawing:



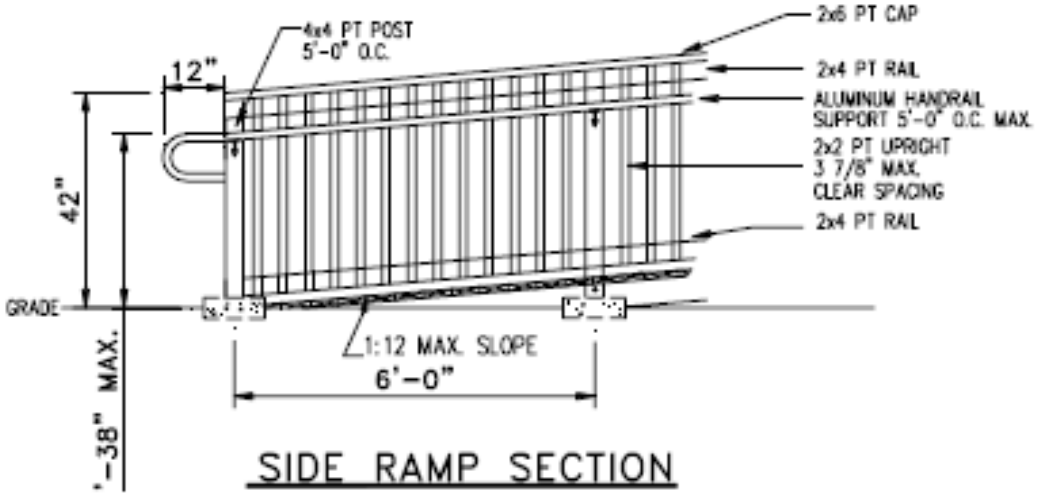
A. The following design guideline drawings are to be used for ramps/walkways:



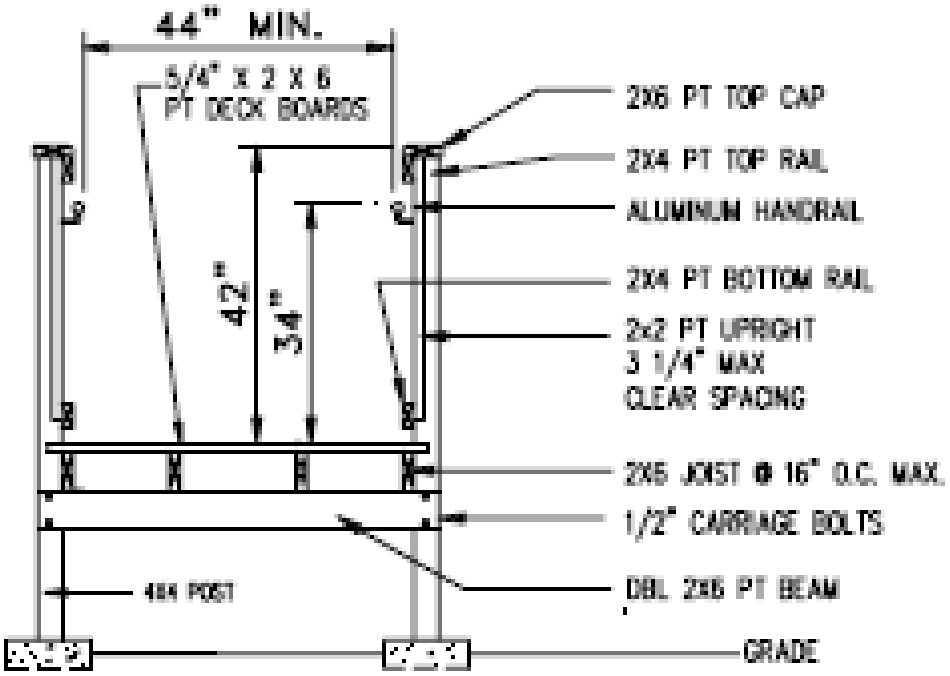
SIDE ELEVATION OF RAMP



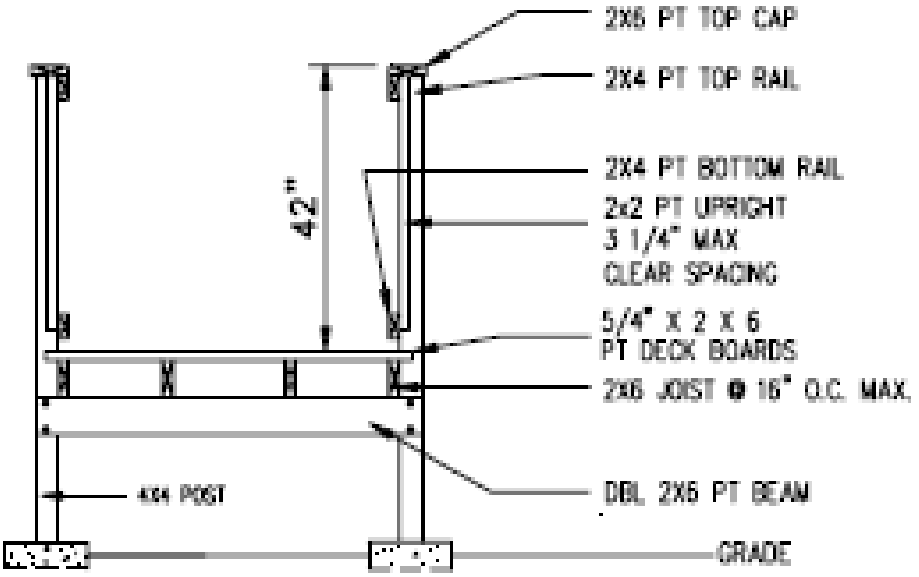
SIDE ELEVATION OF STEP



SIDE RAMP SECTION



STEP/RAMP SECTION



ELEV. WALKWAY SEC 'A'

End of Section 01 52 14

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 55 26 Traffic Control

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 56 39 Temporary Tree and Plant Protection

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 57 10 TPDES Requirements

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 57 19 Control of Ground Surface Water

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 57 21 Indoor Air Quality Controls

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 60 00 Product Requirements

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 73 00 Execution

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 77 00 Closeout Procedures

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.

Item #	Document Description	Primary Responsibility	Date Received by PM	Remarks
3	**EVIDENCE OF PAYMENT OF DEBTS AND CLAIMS**			
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		

Item #	Document Description	Primary Responsibility	Date Received by PM	Remarks
d.	Fire Sprinkler System drawings	GC		Need AHJ approved documents.
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		

==========

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 78 23 Operation and Maintenance Data

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 78 39 Project Record Documents

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

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 79 00 Demonstration and Training

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

sSECTION 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 42 13.10 - 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.

L. Use particular care when removing existing tennis court slabs which have post-tensioned

cables under high tension. It is advised that an independent engineering consultant be consulted by the Contractor to examine existing court prior to beginning work, and to provide safety preparations in demolition of post-tensioned courts to ensure safe removal procedures.

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 17 – SITE DEMOLITION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for site demolition of facilities and structures.

B. Extent of demolition work is shown on Drawings. Demolition may, but not necessarily, require removal and disposal, off the Work Site, of the following:

1. Entrances, drives, parking lots and structures, and adjacent landscape work to limits indicated on Drawings, except items to be removed by OWNER prior to start of work.

2. Paving, curbs, gutters, walkways, and related concrete and asphalt.

1.2 SUBMITTALS

A. In accordance with Division 00 Specifications, the following shall be submitted:

1. Proposed methods and operations of demo to Owner for review and approval prior to start of Work. Include required coordination by agencies for shut-off, capping, and continuation of utility services as required. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of OWNER operations.

1.3 QUALITY ASSURANCE/JOB CONDITIONS

A. Reference Standards Applicable to this Section

1. ANSI: American National Standards Institute

a. A10.6 Safety Requirements for Demolition Operations

2. NFPA: National Fire Protection Association.

a. 30: Flammable and Combustible Liquids Code

b. 241: Standard for Safeguarding Building Construction and Demolition Operations.

B. Regulations

Comply with applicable OSHA and EPA regulations and codes and local ordinances.

C. Condition of Structures and Work Site

OWNER assumes no responsibility for actual condition of site features to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by OWNER insofar as practicable. However, variations within structure and Work Site may occur prior to start of demolition work.

D. Partial Removal

Items of value to Contractor may be removed, as directed, as Work progresses. Salvaged items

shall become the property of the Contractor and shall be transported from Site as they are removed. Storage or sale of removed items on-site will not be permitted.

E. Explosives

Use of explosives will not be permitted.

F. Traffic

Conduct demolition operations and removal of debris to ensure minimum interference with OWNER operations, roads, streets, walks, and adjacent facilities. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction. Provide and identify alternate routes around closed or obstructed traffic ways as required by governing regulations.

G. Protection

Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to persons and adjacent buildings, structures, and facilities. Erect temporary covered passageways as required by authorities having jurisdiction. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

H. Damages

Promptly repair damages caused by demolition operations at no cost to OWNER or adjacent property owners.

I. Utility Services

Maintain existing utilities indicated to remain, keep in like service, and protect against damage during demolition operations. Do not interrupt existing utilities serving facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary service during interruptions to existing utilities, as acceptable to governing authorities. Contractor shall disconnect and seal utilities serving structures to be demolished, prior to start of demolition work, upon written direction of OWNER and utility owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

A. General

Contractor shall comply with NFPA 241 and ANSI A 10.6 prior to and during commencement of demolition.

B. Pollution Control

Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing EPA, OSHA, and local regulations pertaining to environmental protection. Do not create hazardous or objectionable conditions such as flooding and water pollution. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by governing authorities. Return adjacent areas to condition existing prior to start of Work.

C. Below-Grade Construction

Demolish foundation walls to a depth of not less than 12 inches below subgrade or lowest foundation element. Demolish and remove below-grade wood, metal construction, floor construction, and concrete and asphalt slabs.

D. Filling Voids

1. Completely fill below-grade areas and voids resulting from demolition. Coordinate with work of Sections 31 11 00 – Clearing and Grubbing, and 31 00 01- Site Earthwork of these Specifications.

2. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.

3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.

4. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. Compact each layer at optimum moisture content of fill material to a density as specified in Section 31 00 00 - Earthwork of these Specifications.

5. After fill placement and compaction as specified, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.2 DISPOSAL OF DEMOLISHED MATERIALS

A. General

Remove from Work Site debris, rubbish, and other materials resulting from demolition operations. Burning of removed materials from demolished structures will not be permitted on Site.

B. Removal

Safely transport demolished materials and dispose of legally off Site. Contractor shall comply with NFPA 241, ANSI A 10.6, and NFPA 30, as applicable to the Work of disposal and transport.

END OF SECTION 02 41 17

SECTION 03 05 80 - UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. RELATED SECTIONS
   1. Section 03 30 00 Cast-in-place Structural Concrete
   2. Section 01 45 23 Structural Testing and Inspection

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97 (2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
   2. ASTM E 154-88 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98 (2005) Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)
   1. ACI 302.2R-06 Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.

1.3 SUBMITTALS

A. Quality Control / Assurance
   1. Full set of test results as per paragraph 8.3 of ASTM E 1745.
   2. Manufacturer’s samples, literature
   3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.

1.4 SUBSTITUTIONS

A. Product Review
   1. Request must be made 14 days prior to bid date to allow time for proper review. Reviews will be at contractor’s expense.
   2. Independent laboratory test results showing compliance with ASTM E 1745 Class A, a permeance less than 0.01 Perms (grains/(ft2 *hr * in. Hg) before and after the mandatory conditioning tests ASTM E 154 Sections 8,11,12, and 13. (Woven, and recycled plastics are not permitted
   3. Incomplete substitutions will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier (Performance based specification). When the specifications of different sections conflict, the contractor shall perform to the most restrictive provision. Vapor Barrier membrane must have the following properties.
   1. Permeance as tested after mandatory conditioning (ASTM E 154 sections 8,11,12,13) less than 0.01 Perms [grains/(ft2 *hr * in.Hg)]
   2. Other performance criteria
      a. Strength: ASTM E 1745 Class A
      b. Thickness: 15 mils minimum

2.2 ACCESSORIES

A. Seam Tape
   1. Tape must have the following qualities:
      a. Water Vapor Transmission Rate ASTM E 96, 0.3 perms or lower
   2. Seam Tape
      a. Manufacturer’s standard seam tape.
      b. Stego Crete Claw (for slabs on void boxes).

B. Vapor Proofing Mastic
   1. Mastic must have the following qualities:
      a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower

C. Pipe Boots
   1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer’s instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:
   1. Installation shall be in accordance with manufacturer’s written instructions and ASTM E 1643-09.
      a. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
      b. Lap Vapor Barrier/Retarder over footings or seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer’s tape.
      d. Seal all penetrations (including pipes) per manufacturer’s instructions.
      e. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.

f. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

g. In addition to application at membrane seams, apply tape on a maximum 10’-0”x10’-0” grid throughout the membrane surface to assure consistent and complete attachment to the structural slab.

END OF SECTION 03 05 80

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete formwork, for the following:
   1. Footings and/or piers.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Testing and Inspection Services”.
   2. Section 03 30 00 “Cast In Place Concrete”.
   3. Section 03 20 00 “Concrete Reinforcing”.
   4. Section 03 38 16 “Unbonded Post Tensioned Concrete”.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. American Concrete Institute (ACI):
      a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
      b. ACI 301 – Specifications for Structural Concrete for Buildings
      c. ACI 318 – Building Code Requirements for Structural Concrete
      d. ACI 347 – Guide to Formwork for Concrete
      e. ACI SP-4 – Formwork for Concrete.

1.4 PERFORMANCE REQUIREMENTS

A. Design and engineering of formwork, including shores, reshores, false work, bracing, and other temporary supports as well as determining when temporary supports and bracing can safely be removed after the specified curing time is the Contractor’s responsibility.

B. All components of the formwork shall be designed to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

C. If any post tensioned members exist on the project, the formwork supporting those elements shall:

1. It is essential to take into account the stressing sequence of post-tensioned concrete in the design of the formwork. Any concrete element which is stressed can transfer its weight off the form work to the supporting concrete element in which case the forms for the supporting concrete element must be designed to support the entire load tributary of that element.
2. Forms shall be designed and constructed to permit movement during stressing, both lifting and shortening of the concrete elements.
3. Formwork supporting beams and girders shall be designed to support the weight of the beam or girder's entire tributary area.
4. Formwork supporting post tensioned concrete elements shall not be removed until all concrete supported by the formwork has been fully stressed, but in no case shall the curing time before form removal be less than specified herein.
5. Design, engineering and production of shop drawings for the form work shall be performed under the supervision of a professional engineer.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings for layout of pan type forms, if they exist on the project. Layout only - information and details about the support of these forms is not required, as it is the responsibility of the Contractor and his registered engineer
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

D. Manufacturer's product data and installation instruction for propriety materials used in exposed concrete work including form liners, release agents, form systems, ties, and accessories.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver form materials in manufacturer's packaging with installation instructions.

B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. An experienced installer who has completed work 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. Testing Agency Qualifications: Refer Section 01 45 23.

C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

D. Design, engineering and construction, and removal of formwork are the responsibility of the contractor.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Permanent Metal Forms for Slabs: Deck material, gauge and rib pattern shall be as noted on Drawings.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
   1. Pans shall be free of dents, irregularities, sag, rust or other deterioration.
   2. In areas permanently exposed to view, provide one piece units, manufactured to length between beams or ribs, or segmented units with reinforced butt-joint splices.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch
   3. Class C, 1/2 inch
   4. Class D, 1 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts that are attached to the formwork.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.
   4. Install accessories in accordance with manufacturer’s instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Determine compressive strength of in place concrete by testing representative field-cured test specimens according to ACI 301.

B. Obtaining concrete compressive strength tests for the purposes of form removal shall be the responsibility of the Contractor.

C. In the absence of cylinder tests, formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit (10 degrees Celsius) for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. When the surrounding air temperature is below

50 degrees Fahrenheit (10 degrees Celsius), that time period shall be added to the minimum listed time period.

D. Formwork for two-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for one-way slabs of the same maximum span. Two-way conventionally reinforced slabs shall then be reshored until they attain the specified 28 day strength.

E. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems that allow form removal without displacing shores. However, the Contractor must demonstrate, to the satisfaction of the Architect, that the early removal of forms will not result in excessive sag, distortion or damage to the concrete elements.

F. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

G. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. The Contractor shall be solely responsible for proper shoring and reshoring. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. Reshores shall be located in the same position on each floor. No construction loads shall be placed on the new construction until all supporting reshores have been installed.
   1. Extend shores or reshores from ground to top level in structure three stories or less in height, unless noted otherwise.
   2. In structures over three stories in height, extend shores or reshores at least three levels under the level being placed. Extend shores beyond the minimum number of levels if required to ensure proper distribution of loads throughout the structure.
   3. In crawl spaces or basement, shores or reshores shall extend to mud pads seated firmly on the soil or to on grade construction.

D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

E. Bottom tier of reshores shall remain in place until the supported concrete has attained at least 85 percent of the specified 28 day compressive strength and construction loads in excess of 20 psf have been removed but not less than 14 days.

3.5 REUSE OF FORMS

A. Clean and repair surfaces of forms to be used in the Work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Otherwise, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are to be installed.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces indicated or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated or to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the 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 at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment

END OF SECTION 03 10 00

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete reinforcement, for the following:
1. Footings and/or piers.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.

B. Related Sections:
1. Section 01 45 23 “Testing and Inspection Services”.
2. Section 03 10 00 “Concrete Forming and Accessories”.
3. Section 03 30 00 “Cast In Place Concrete”.
4. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
5. Section 04 22 00 “Concrete Unit Masonry”.
6. Section 31 20 00 "Earth Moving".
7. Section 31 63 29 "Drilled Concrete Piers and Shafts".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. American Concrete Institute (ACI)
   a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
   b. ACI 301 – Specifications for Structural Concrete for Buildings
   c. ACI 315 – Details and Detailing of Concrete Reinforcement
   d. SP-66 ACI Detailing Manual
2. American Welding Society (AWS)
   a. AWS D1.1 – Structural Welding Code
3. Concrete Reinforcing Steel Institute (CRSI)
   a. CRSI – Manual of Standard Practice
   b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
   c. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

B. American Society of Testing Materials (ASTM)
   a. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.

b. ASTM-A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
c. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
d. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
e. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
f. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
g. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.

C. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement, according to ACI 315 “Details and Detailing of Concrete Reinforcement.”
1. Do not reproduce the structural drawings for use as shop drawings.

D. Bar Supports: Submit manufacturer’s product information for bolsters, chairs, spaces, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency, installer, and fabricator as indicated herein.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Steel reinforcement and accessories.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Installer Qualifications: An experienced installer who has completed reinforcing installation work 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.

C. Fabricator Qualifications: An experienced fabricator who has completed reinforcing fabrication work 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.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

E. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.

C. Low-Alloy-Steel Reinforcing Bars for bars to be welded: ASTM A 706, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.

D. Stainless-Steel Reinforcing Bars: ASTM A 955, Grade 60, [Type 304] [Type 316L], deformed.

E. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 or ASTM A 706, deformed bars, assembled with clips.

F. Plain-Steel Wire: ASTM A 82, as drawn .

G. Deformed-Steel Wire: ASTM A 496.

H. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

I. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, or other unacceptable materials.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Combined tolerances for formwork, reinforcing fabrication, and reinforcing placement shall not permit a reduction in specified concrete cover of reinforcing steel. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken material. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
1. Sheared length: Plus or minus 1 inch.
2. Depth of truss bars: Plus 0, minus ½ inch.
3. Overall dimensions of stirrups, ties, and spirals: Plus or minus ½ inch.
4. Other bends: Plus or minus 1 inch.

B. For bars with end bearing splice couplers, bar ends shall terminate in flat surfaces, within 1.5 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

2.4 DOWEL BAR ANCHORS/SPLICERS

A. A. Provide dowel bar anchors and threaded dowels designed to develop, both in tension and compression, 125% of the minimum ASTM specified yield strength of the dowel bars, as evidenced by published I.C.B.O. test reports. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by anchor supplier. The following dowel splicing systems are acceptable.
1. Richmond Screw Anchor “Dowel Bar Splicer”
2. Erico “Lenton Form Saver”
3. Dayton Barsplice “Grip-Twist”

2.5 MECHANICAL SPLICES

A. A. Provide mechanical splices designed to develop, both in tension and compression, 125% of minimum ASTM yield strength of the smaller bar being coupled, as evidenced by published I.C.B.O test reports. The following bar splicing systems are acceptable.
1. Erico “Cadweld C-Series”
2. Erico “Lenton”
3. Dayton Barsplice “Bar Grip”
4. Dayton Barsplice “Grip Twist”

2.6 METAL ANCHORAGE AND EMBEDDED METAL ASSEMBLIES

A. Steel Shapes and Plates: Conform to ASTM A36, “Specification for Structural Steel”.

B. Headed Stud Anchors: Headed studs welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

C. Welding Electrodes: AWS 5.5, Series E70.

D. Welded Deformed Bar Anchors: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

E. All metal assemblies exposed to earth, weather or moisture, including exposure to a crawl space environment, shall be hot dip galvanized.

2.7 FABRICATION OF METAL ACCESSORIES AND EMBEDDED METAL ASSEMBLIES

A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of metal and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges. Welded construction shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and AWS D1.1. Welding shall be done by AWS certified welders.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division of KSM Welding Services Division, Omark, Ind. A minimum of two headed studs shall be tested at start of each production period for proper quality control. Studs shall be capable of being bent 45 degrees without weld failure.

C. Welding of reinforcement shall be done in strict accordance with AWS requirements, using recommended preheat temperature and electrode for type of reinforcement being welded. Bars larger than No. 9 shall not be welded. Welding shall be performed subject to the observance and testing laboratory. Under no circumstances is ordinary reinforcing (ASTM A615) to be welded.

D. Coatings, where required, shall be applied after fabrication and prior to casting concrete.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Provide minimum concrete covering for reinforcement as shown in the Structural General Notes.

G. Place bars to following tolerances:
   1. Clear distance to formed surfaces: Plus or minus ¼ inch.
   2. Minimum spacing between bars: Minus ¼ inch.
   3. Top bars in slabs and beams:
      a. Members 8 inches deep or less: Plus or minus ¼ inch.
      b. Members between 8 and 24 inches deep: Plus or minus ½ inch.
      c. Members more than 24 inches deep: Plus or minus 1 inch.
   4. Crosswise of members: Spaced evenly within 2 inches.
   5. Length of members: Plus or minus 2 inches.

H. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.

I. Support reinforcement and fasten together to prevent displacement by construction loads or placing concrete beyond tolerances indicated.

J. Unless permitted by Engineer, do not bend reinforcement after embedding in hardened concrete.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.

END OF SECTION 03 20 00

SECTION 0330 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Structural Testing and Inspection Services”.
   2. Section 03 20 00 "Concrete Forming and Accessories".
   3. Section 03 10 00 "Concrete Reinforcing".
   4. Section 03 15 13 “Waterstops”.
   5. Section 03 05 80 “Under-slab Vapor Barrier – Retarder”.
   6. Section 31 63 29 “Drilled Concrete Piers and Shafts”.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. ACI 301 – Specification for Structural Concrete.
   2. ACI 302 – Guide for Concrete Floor Slab Construction.
   3. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   4. ACI 305 – Hot Weather Concreting.
   5. ACI 306 – Cold Weather Concreting.
   6. ACI 308 – Guide to Curing Concrete.
   7. ACI 309 – Guide for Consolidating Concrete.
   8. ACI 311 – ACI Manual for Concrete Inspection.
   9. ACI 318 – Building Code Requirements for Reinforced Concrete.
   10. ACI 347 – Guide to Concrete Formwork.
   11. ACI 207 – Mass Concrete.
   12. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   13. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
   14. ACI 212.3 – Chemical Admixture for Concrete.

15. ACI 212.4 – Guide for the use of High Range Water Reducing Admixtures in Concrete.
16. ACI 214 – Evaluation of Strength Test Results of Concrete.
17. ACI 303 – Guide to Cast in Place Architectural Concrete Practice.
18. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit IEQ 4.3: For liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content.
3. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements, and for equivalent concrete mixtures that do not contain Portland cement replacements.

C. Design Mixtures: For each concrete mixture include the following information. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Each proposed mix design shall be accompanied by a complete standard deviation analysis based on at least 30 consecutive strength tests, or by three laboratory trial mixtures with confirmation tests.
2. Proportions of cement, fine, and coarse aggregate, and water.
3. Design strength.
4. Maximum slump.
5. Air Content.
6. Maximum water / cement ratio.
7. Maximum and minimum concrete temperature that is acceptable at time of placement for which the manufacturer can guarantee the strength of the concrete.
8. Type cement and aggregates.
9. Type and quantities of all admixtures.
10. Air dry density and splitting tensile strength for lightweight concrete determined in accordance with ASTM 330.
11. Type, color, and quantities of integral coloring compounds, where applicable.
12. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Refer Section 03 20 00.

E. Formwork Shop Drawings: Refer Section 03 10 00.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Fiber reinforcement.
   4. Curing compounds.
   5. Floor and slab treatments.
   6. Bonding agents.
   7. Adhesives.
   8. Semi rigid joint filler.
   9. Joint-filler strips.
   10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: See Section 01 45 23.
   1. Contractor’s responsibility to testing laboratory.
      a. Furnish all labor and materials as required to assist testing agency in obtaining, making and handling samples at the jobsite.

b. Advise the Owner's Testing Laboratory sufficiently in advance of operations to allow adequate time for the assignment of testing personnel.
c. Furnish and maintain adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. See Section 03 10 00.

2.2 STEEL REINFORCEMENT

A. See Section 03 20 00.

2.3 REINFORCEMENT ACCESSORIES

A. See Section 03 20 00.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C. Carbon content shall not exceed 3 percent by volume.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal as indicated on Drawings for specific uses.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain not more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters.
      b. Davis Colors.
      c. Dayton Superior Corporation.
      d. Hoover Color Corporation.
      e. Lambert Corporation.
      f. QC Construction Products.
      g. Rockwood Pigments NA, Inc.

h. Scofield, L. M. Company.
i. Solomon Colors, Inc.

2. Color: As selected by Architect from manufacturer's full range.

2.6 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. 3M; Scotchcast Polyolefin Fibers 2".
   b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
   c. FORTA Corporation; FORTA FERRO.
   d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
   e. Nycon, Inc.; XL.
   f. Propex Concrete Systems Corp.; Fibermesh 650.
   g. Sika Corporation; Sika Fiber MS or MS10.

2.7 CONCRETE MIX DESIGNS

A. Selection of Proportions: Proportions of ingredients for concrete mixes shall be determined by a qualified concrete supplier in accordance with the requirements of ACI 301.

B. Required average strength above specified strength: Determination of required average strength above specified strength shall be based on the standard deviation record of the production facility in accordance with ACI 301. Calculation of standard deviation of compressive strength results shall be made in accordance with ACI 214. If a suitable record of strength tests is not available, proportions shall be selected on the basis of laboratory trial batches to produce an average strength greater than the strength f’c by the amount defined in ACI 301.

2.8 VAPOR RETARDERS

A. See Section 03 05 80.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Anti-Hydro International, Inc.; Emery.
   b. Dayton Superior Corporation; Emery Tuff Non-Slip.
   c. Lambert Corporation; EMAG-20.
   d. L&M Construction Chemicals, Inc.; Grip It.
   e. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc.; A-H Alox.
      b. BASF Construction Chemicals - Building Systems; Frictex NS.
      c. L&M Construction Chemicals, Inc.; Grip It AO.

2.10 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ChemMasters; Chemisil Plus.
      b. ChemTec Int'l; ChemTec One.
      c. Conspec by Dayton Superior; Intraseal.
      d. Curecrete Distribution Inc.; Ashford Formula.
      e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      f. Edoco by Dayton Superior; Titan Hard.
      g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
      h. Kaufman Products, Inc.; SureHard.
      i. L&M Construction Chemicals, Inc.; Seal Hard.
      j. Meadows, W. R., Inc.; LIQUI-HARD.
      k. Metalcrete Industries; Floorsaver.
      l. Nox-Crete Products Group; Duro-Nox.
      m. Symons by Dayton Superior; Buff Hard.
      n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
      o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Advanced Floor Products; Retro-Plate 99.
      b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
      c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
      b. BASF Construction Chemicals - Building Systems; Confilm.
      c. ChemMasters; SprayFilm.
      d. Conspec by Dayton Superior; Aquafilm.
      e. Dayton Superior Corporation; Sure Film (J-74).
      f. Edoco by Dayton Superior; BurkeFilm.

g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.
d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
g. Lambert Corporation; UV Safe Seal.
h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.

i. Meadows, W. R., Inc.; Vocomp-30.
j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.14 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: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, as indicated in Structural General Notes.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.15 NON-SHRINK GROUT

A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
   1. “Euco NS” by Euclid Chemical Company
   2. “Masterflow 713” by Master Builders.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated in Structural General Notes:

2.17 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. See Section 03 10 00.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. See Section 03 10 00.

3.4 SHORES AND RESHORES

A. See Section 03 10 00.

3.5 VAPOR RETARDERS/BARRIERS

A. See Section 03 05 80.

3.6 STEEL REINFORCEMENT

A. See Section 03 20 00

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are specified or otherwise indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Do not permit concrete to drop freely any distance greater than 10’-0” for concrete containing a high range water reducing admixture or 5’-0” for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 305 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water

equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. See Section 03 10 00.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and/or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated and/or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and/or exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces according to ASTM E 1155, for a randomly trafficked floor surface.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistivegranules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive granules.

3.11 CONCRETE FLOOR FINISH TOLERANCES

A. Interior Finish Floor surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." The following values apply before removal of shores. Levelness values F(L) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
   1. Exposed, vinyl tiled, or thin-set tiled floors: Specified overall values of flatness, Ff =35; and levelness, Fl =25; with minimum local values of flatness, Ff =24; and levelness, Fl =17.
   2. Carpeted floors, floors under concrete toppings, thickset tile and terrazzo: Specified overall values of flatness, Ff =25; and levelness, Fl = 20; with minimum local values of flatness, Ff =17; and levelness, Fl =15.

B. Floor Elevation Tolerance Envelope:
   1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
      a. Slab-on-Grade, or Slab-on-Void Construction: +/- 3/4"
      b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
      c. Top surfaces of all other slabs: +/- 3/4"
      d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the 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 at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturers written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
   2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
   4. Control and dispose of waste products produced by grinding and polishing operations.
   5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

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 07 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 01 40 00 "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 03 52 13 – CELLULAR INSULATING CONCRETE ROOF FILL

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. Section includes cellular-type insulating concrete fill over structural roof decking.

B. Related Sections:
1. Section 05 31 23 - Steel Roof Decking (and structural notes): Requirements for ventilated decking.
2. Section 06 10 00 - Rough Carpentry: Wood blocking, curbs.
3. Section 07 52 00 – Modified Bitumen Membrane Roofing.

1.3 SUBMITTALS

A. Product Data: Include mixing and application instructions for lightweight concrete roof insulation.

B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight concrete roof insulation thicknesses, embedded board insulation, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

C. Design Mixes: Provide mix for each lightweight concrete roof insulation mix.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated, based on comprehensive testing of current materials:
1. Cement.
2. Admixtures.
3. Insulation board.

E. Research/Evaluation Reports: Evidence of lightweight insulating concrete roof insulation's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cellular lightweight insulating concrete roof installations 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.
1. Cellular lightweight insulating concrete roof fill type and specific mix shall be approved in writing by roofing system manufacturer for the specified roofing type.
2. Cellular lightweight insulating concrete roof fill installer shall be approved by the cellular lightweight insulating concrete manufacturer.

B. Tested Systems:
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
2. ASCE-7-10: Provide wind uplift standard with a tested assembly to meet uplift calculation where building is located, matched to the roofing system specified.
3. FM Listing: Provide system listed in FM's "Approval Guide" for Class 1 fire rating, listed in UL “Roofing Materials Directory”.

C. Provide aggregates containing no detectable asbestos as determined by the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

D. Provide copy of cellular lightweight insulating concrete fill manufacturer’s 20 year, NDL warranty meeting requirements as specified herein.

E. Installer is responsible for ensuring positive drainage of the cellular lightweight insulating concrete deck. Ponding water shall be cause for rejection of the installation. Prior to installation of the roof system, the installer shall perform a ponding water test on the deck to confirm deck drainage with no evidence of ponding water. Test shall be conducted in the presence of the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.6 WARRANTY

A. Manufacturer’s Warranty: Insulating concrete roof fill manufacturer shall warrant the insulating concrete roof fill system from the Project date of Substantial Completion as follows:
   1. Refer to roofing system specification section for length of warranty period.Warranty shall be a NDL “No Dollar Limit” / no penal sum type, with total replacement cost.
   2. The warranty shall provide manufacturer’s maximum extended wind rated coverage (up to hurricane force winds) as defined by the Beaufort Scale.
   3. The warranty shall guarantee the entire insulating concrete roof fill system against defective materials and workmanship of installation, with NO exclusion for ponding water.
   4. The full insulating concrete roof fill system warranty shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.
   5. The cellular lightweight insulating concrete assembly R-Value shall be warranted to be stable, with no R-Value drift, and acceptable to the roofing manufacturer, and will be covered under the roofing manufacturer’s warranty for the same period of time.
   6. Installer’s Warranty: Installer shall guarantee that the work performed under this Contract will be free from defects in workmanship and materials, and that the insulating concrete roof fill will remain in good condition for a five-year warranty period from the date of Substantial Completion.

1.7 PROJECT CONDITIONS

A. Do not place cellular lightweight insulating concrete roof deck unless ambient temperature is 40 deg F (4.4 deg C) and rising.

B. Do not place cellular lightweight insulating concrete assembly during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 SYSTEMS AND MANUFACTURERS:

A. Coordination: It is the responsibility of Insulating Concrete Roof Fill Bidders to coordinate during the bid period with listed roofing membrane manufacturers in the Roofing Section to ensure that the Insulating Concrete Roof Fill product proposed meets all requirements of the roofing membrane manufacturers for their product and the specified roofing warranty. Some or all of the specified roofing manufacturers may not accept vermiculite product as an approved substrate for their membrane.

B. Cellular-Type Lightweight Insulating Concrete:
1. Celcore Incorporated, www.celcoreinc.com
2. Elastizell Corporation of America, www.elastizell.com
3. Mearlcrete, Inc., www.aerixindustires.com
4. Siplast Inc., www.siplast.com
5. Substitutions: Section 01 60 00 - Product Requirements.

C. Insulation Board:
1. *Insulperm* as manufactured by Siplast.
2. *Starrfoam-HB* as manufactured by Starrfoam Manufacturing.
3. Substitutions: Section 01 60 00 - Product Requirements.

D. Metal Deck: Reference Section 05 31 00 Steel Decking.

2.2 CELLULAR-TYPE INSULATING CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I II or III.

B. Foam Concentrate: Protein-based foam concentrate conforming to ASTM C869 and ASTM C796.

C. Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi (172 kPa).

D. Molded-Polystyrene Insulation Board: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density. Provide units with keying slots of approximately 3 percent of board's gross surface area.

E. Curing Compound: Type recommended by manufacturer.

F. Cellular Mix Properties (provide greater than minimums where required by the roofing membrane manufacturer):
1. Wet Density: 53 to 63 lb./cu. ft. when tested according to ASTM C138.
2. Oven-Dry Density: 31 to 37 lb/cu.ft., when tested according to ASTM C 495.
3. Compressive Strength: Minimum 350 psi when tested according to ASTM C 495.

G. Where selected roofing manufacturer requires more stringent requirements, those requirements shall govern.

H. Polypropylene Linked: 3/4” pre-packaged reinforcing fibers impregnated with a dispersing agent. Brand as recommended by the lightweight insulating concrete manufacturer.

2.3 DESIGN MIXES - GENERAL

A. Prepare design mixes for each type and strength of lightweight concrete roof insulation by either laboratory trial batch or field-test data methods. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

C. Do not use the same testing agency for field quality-control testing.

D. Do not use Calcium dioxide in lightweight insulating concrete fill.

E. Design mix to produce lightweight concrete roof insulation with the specified minimum physical properties using the minimum amount of water necessary to produce a workable mix. Do not exceed maximum air content recommended by aggregate manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Metal Deck: Ensure that metal deck to receive insulating concrete fill is g-90 galvanized, 22-ga.and ventilated to meet manufacturer’s requirements. Lightweight insulating concrete shall not be installed over a non-ventilated deck regardless of whether allowed by manufacturer or submittals.

B. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of lightweight concrete roof insulation. Fill control joints with joint filler.
1. Provide 1 inch (25 mm) wide control joints for roof dimensions up to 100 feet (30 m) in length; 1-1/2 inch (38 mm) wide control joints for roof dimensions exceeding 100 feet (30 m).

3.2 MIXING AND PLACING

A. Mix and place lightweight concrete roof insulation according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mix and loss of air content.
1. Add 1-lb./cu. yd. of the specified reinforcing fibers to each batch during mixing operations.

B. Install insulation board according to lightweight concrete roof insulation manufacturer's written instructions.
1. Install slurry to fill steel deck to a minimum of 1/4-inch above top of flutes.
2. Place board insulation in wet slurry and walk board in to ensure full contact of board insulation with slurry. Do not kick the boards into place.
3. Stagger joints, and tightly butt insulation boards.
4. Where insulation changes thickness, install insulation boards in a stair-step configuration with a maximum step-down of 1-inch.

C. Install lightweight concrete and screed to a minimum thickness of 2-inches above top of insulation boards.

D. Deposit and screed lightweight concrete roof insulation in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.

E. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

F. Begin curing operations immediately after placement, and air cure for not less than three days according to manufacturer's written instructions.

G. If ambient temperature falls below 32-deg F (0 deg C), protect lightweight concrete roof insulation from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

3.3 CURING

A. Protect insulating concrete from excess evaporation of surface moisture.

B. During low humidity conditions, sprinkle water over concrete surface to aid hydration and curing.

C. Apply curing compound where recommended by manufacturer.

D. Protect installed lightweight concrete from rain until installation of roof membrane.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports evaluating insulating concrete roof fill. Sampling and testing for quality control may include requirements specified in this Article.

C. Testing Laboratory: Take four test samples from each 100 or less cu yds of insulating concrete placed, daily.
   1. Test 1 cylinder after 7 days and 2 cylinders after 28 days. Report failed tests to Owner immediately.
   2. If needed, final cylinder will be tested after 56 days at the request and expense of the Contractor.
   3. Take one additional test sample during cold weather concreting.

D. Testing agency shall take samples according to ASTM C 172, Standard Practice for Sampling Freshly Mixed Concrete except as modified by ASTM C 495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.
   1. Installed materials shall be considered as non-complying if representative samples do not show test results for the physical properties specified herein, or additional non-specified properties as required by the Insulating Concrete manufacturer.

E. Pull Tests: Reference roofing section for pull tests requirements.

3.5 DEFECTIVE WORK

A. Refinish, or remove and replace, insulating concrete roof fill if surfaces are excessively scaled or too rough to receive roofing, according to roofing membrane manufacturer's written requirements.

B. Remove and replace insulating concrete roof fill that fails to comply with compressive-strength and oven-dry unit weight requirements.

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 31 13 – Project Coordination
2. Section 01 40 00 – Quality Requirements: Materials Testing.
3. Section 04 20 00 - Unit Masonry Assemblies.
4. Section 04 29 00 – Engineered Unit Masonry.
5. 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 31 13 – Project Management and Coordination: 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. Masonry joint reinforcement.
4. Ties and anchors.
5. Embedded flashing.
6. 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 – Reinforced Unit Masonry.
4. Section 07 27 26 – Fluid-Applied Membrane Air Barrier.
5. 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 C90 - Standard Specification for Loadbearing Concrete Masonry Units.
3. 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 concrete masonry units, fabricated wire reinforcement, anchors, 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 cleaning material manufacturers regarding the compatibility of proposed use of products together for cleaning purposes.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

D. 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.

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: Match ratings of any existing walls receiving patching or replacement.
   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.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 81 19 – Project Meetings: 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 31 13 – Project Coordination: 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. 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.

B. 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. Size: Modular Size as indicated in the drawings.
2. Manufacturer: As distributed locally by Upchurch-Kimbrow, or approved equivalent as distributed locally by Acme.
3. 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.

C. 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 25 00 – Substitution Procedures.

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. Reinforcing Steel: Type specified in Section 03 20 00.

E. 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.

F. 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. Basis of Design: Hohmann & Barnard, #270 Ladder Eye-Wire.

G. 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: Heckman Building Products, Pos-i-Tie.

H. 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.

2.3 EMBEDDED FLASHING MATERIALS

A. Stainless Steel: ASTM A240, Type 304, soft temper; 0.016 inch thick; smooth finish.

B. Sawtooth Metal Flashing: 26 ga. Type 304 stainless steel
   1. Basis of Design: Hohmann & Barnard MFL-STF

C. 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.

D. 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.

E. 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 25 00 – Substitution Procedures**.

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 25 00 – Substitution Procedures.

F. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 – Project Coordination: 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.

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.

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. Isolate masonry from vertical structural framing members.

12. 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.
13. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

E. 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.

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. Lintels:
1. 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.
2. Maintain minimum 8 inch bearing on each side of opening.

K. 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.

L. 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.

M. 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. Openings in Interior Walls: 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.
   c. 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.

N. 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.

O. 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.

3.5 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 trim flush at base of wall.

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 77 00 – Closeout Procedures: 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

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.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 77 00 – Closeout Procedures: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

END OF SECTION

SECTION 04 29 00 - REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing all labor, materials, and services incidental to the installation of steel reinforcing for CMU, brick, and stone masonry:

B. Related Sections:
1. Section 01 40 00 – Quality Requirements: Materials testing.
2. Section 04 05 03 – Masonry Mortaring.
3. Section 04 20 00 – Unit Masonry Assemblies.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

B. Requirements of Division 4 Section "Unit Masonry Assemblies" apply to Work of this Section.

1.3 SUMMARY

A. This Section consists of furnishing all the labor, materials, and services incidental to the installation of reinforced unit masonry.

1.4 DESCRIPTION OF WORK

A. Extent of each type of reinforced unit masonry work is indicated on drawings and in schedules.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work. Submit shop drawings showing wall elevations with all masonry openings and reinforcement.

B. 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.

C. Testing Reports: The independent testing laboratory shall submit laboratory test reports for materials used directly to the Architect/Engineer with copy to others in accordance with the provisions of Division 1 Section "Quality Control Services." State in each report whether or not the test specimens comply to the specified requirements, and indicate any deviations therefrom.

PART 2 - PRODUCTS

2.1 UNIT MASONRY

A. General: Refer to Division 4 Section "Unit Masonry Assemblies" for masonry materials and accessories not included in this Section.
B. Products:
   1. Featherlite Building Products.
   2. Texas Building Products.
   3. Revels Block & Brick Co., Inc.
   4. Best Block Construction Materials.
   5. Substitutions: **Section 01 25 00 – Substitution Procedures**.

C. Masonry Compressive Strengths:

   1. Minimum masonry compressive strength (f'm) = 1500 psi.
   2. Concrete Masonry Units: ASTM C 90, with a minimum of 1700 psi, minimum average of three units on the net area.
   3. Mortar : ASTM C 270, Type S.
   4. Grout : ASTM C 476, with a minimum Compressive Strengths of 2500 psi.

2.2 REINFORCEMENT BARS

A. General: Provide deformed bars to following grades complying with ASTM A 615, except as otherwise indicated.

   1. Provide Grade 40 for bars No. 3, except as otherwise indicated.
   2. Provide Grade 60 for bars No. 4 to No. 18, except as otherwise indicated.
   3. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

A. General: Clean reinforcement loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcing accurately at the spacing indicated. Support secure vertical bars against displacement. Horizontal reinforcing may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater). Minimum clearance between masonry and reinforcement shall be 1/2".

   1. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as indicated. Refer to the general notes on the drawings for minimum clearance between the main reinforcement and the masonry.

C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8" on exterior face of walls and 1/2" at other locations.

E. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

F. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
   1. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

G. Foundation dowels: Dowels in the foundation shall be placed to align with cores containing reinforcement.

3.2 INSTALLATION, GENERAL

A. Refer to Division 4 Section "Unit Masonry Assemblies" for general installation requirements to unit masonry.

B. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

   1. Construct Formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout, or concrete (if any). Brace, tie and support as required to maintain portion and shape during construction and curing of reinforced masonry.

C. Do not remove forms and shores until reinforced masonry member have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

   1. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
      a. 10 days for girders and beams.

3.3 INSTALLATION OF REINFORCED BRICK MASONRY

A. Mortar Jointing and Bedding:
   1. Pattern Bond: Lay exterior wythes in the pattern bond shown, or if not shown, lay in 1/2-running bond with vertical joints in each course centered on units in courses above and below. Lay inner wythes (if any) with all units in a wythe bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners and intersections. Do not use units with less than 4" nominal horizontal face dimension at corners or jambs.
   2. Lay exterior wythes with bed (horizontal) and head (vertical) joints between units completely filled with mortar. Top of bed joint mortar may be sloped toward center of walls. Butter ends of units with sufficient mortar to completely fill head joints and shove into place. Do not furrow bed joints or slush head joints. Remove any mortar fins which protrude into grout space.

      a. Maintain joint widths shown for head and bed joints, but adjust thickness of bed joints, if required, to allow for not less than 1/4" thickness of mortar between reinforcement and masonry units, except 1/4" bars (if any) may be laid in 1/2" thick bed joints and No. 6 gage or smaller wire reinforcing (if any) may be laid in 3/8" thick bed joints.

B. Two-Wythes Wall Construction: Lay both wythes as previously specified for exterior wythes. Maintain grout space (collar or continuous vertical joint between wythes) of width indicated, but adjust, if required, to provide grout space not less than 1/2" wider than the sum of the vertical and horizontal (if any) reinforcement bars shown to be placed in grout space. Do not parge or fill grout space with mortar.

C. Limit extent of masonry construction to sections which do not exceed the maximum pour requirements specified hereafter. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.

D. Low-Lift Grouting:
   1. Use Low-Lift grouting technique with "Fine Grout" per ASTM C 476 for the following:
      a. Two-wythe walls with grout space of 2" or less in width.

   2. Use Low-Lift grouting technique with "Coarse Grout" per ASTM C 476 for the following:
      a. Columns, piers or pilasters where masonry units are shown in core areas enclosed by exterior masonry units.

   3. Construct low-lift masonry by placing reinforcement, laying masonry units and pouring grout as the work progresses.

   4. Place vertical reinforcement bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcement bars may be placed progressively with laying of masonry units.

   5. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 12" pour height.

   6. Lay masonry units prior to each grout pour, but do not construct more than 12" above maximum grout pour height in one exterior wythe and 4" above in other exterior wythe. Provide metal wall ties if required to prevent blowouts.

   7. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1-1/2" below top of highest course in pour.

3.4 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

   1. Where solid CMU units are shown, lay with full mortar head and bed joints.

C. Walls:

   1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where

shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

4. Columns, Piers and Pilasters:
   a. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
   b. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
   c. Lay wall and pilaster units together to maximum pour height specified.

D. Grouting:
   1. Use “Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions and bond beams.
   2. Use "Coarse Grout" per ASTM C 476 for filling 4" spaces or larger in both horizontal directions and formed beams.

E. Low-Lift Grouting:
   1. Use Low-Lift grouting technique for all walls and bond beams.

   2. Provide minimum clear dimension of 2" 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' height, or if bond beam occurs below 5' 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" below top course of pour.

   7. Bond Beams: Stop grout in vertical cells 1-1/2" 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.

F. High-Lift Grouting:
   1. High-lift grouting technique may be used for the following masonry construction:
      a. Columns, piers, pilasters, or formed beams.

2. Provide cleanout holes in first course of each grout pour at all vertical cells which are to be filled with grout.
   a. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.

3. Construct masonry to full height of maximum grout specified, prior to placing grout.
   a. Limit grout lifts to a maximum height of 5' and grout pour to a maximum height of 12', unless otherwise indicated.

4. Place vertical reinforcement before grout placement. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10'.
   a. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcing bar, pull loops and bar to proper position and tie free ends.

5. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

6. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.

   a. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8 gage wire ties spaced 16" o.c. for members with 20" or less side dimensions, and 8" o.c. for members with side dimensions exceeding 20".

7. Preparation of Grout Spaces: Prior to placement, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcing and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

   a. Do not place grout until entire height of masonry to be poured has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

   b. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.

   c. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 5'. Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

   d. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section. Repeat sequence if more pours are required.

3.5 FIELD QUALITY CONTROL

A. General: An independent testing agency shall perform tests and to submit test reports.

B. Minimum Tests and Submittals:
   1. Certificate for materials used in masonry construction indicating compliance with contract documents.

   2. Verification of Minimum masonry compressive strength (f'm) prior to construction and every 5000 sq. ft during construction. Perform compressive strength "Prism Test" per ASTM C1314.

   3. Verification of proportions of materials and grout as delivered to the site.

   4. Test mortar in accordance with the property specification of ASTM C 270 or evaluate with ASTM C 780.

   5. Sample and test grout in accordance with ASTM C 1019 for each 5000 sq. ft.

C. Minimum Inspection:

   1. From the masonry construction and continuously during construction of masonry, verify the following are in compliance:
      a. Proportion of site-mixed mortar and grout.
      b. Placing of masonry units and construction of mortar joints.
      c. Placement of reinforcement and connectors.
      d. Grout space prior to grouting.
      e. Placement of grout.

   2. Observe preparation of grout specimens, mortar specimens, and/or prisms.

   3. Verify compliance with the required inspection provisions of the contract documents and the approved submittals.

D. Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of tests shall contain the Project identification name and number, date of test, name of testing service, mortar or grout type and class, location of mortar or grout batch in structure, design compressive strength at 28 days, mortar or grout 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.

E. Additional Tests: The testing agency will make additional tests of in-place masonry when test results indicate specified 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 materials by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 0512 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Structural steel.
2. Prefabricated building columns.

B. Related Sections:
1. Section 01 45 23 "Testing and Inspection Services".
2. Section 05 31 13 "Steel Floor Decking".
3. Section 05 31 23 "Steel Roof Decking".
4. Section 05 50 00 "Metal Fabrications".
5. Section 05 51 00 "Metal Stairs."

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6 with flanges thicker than 1 1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 REFERENCES

A. Comply with applicable provisions of the following specifications and documents: The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise
1. AISC "Code of Standard Practice for Steel Buildings and Bridges”.

2. AISC "Specification for Structural Steel Buildings," including the "Commentary" and the Supplements thereto, as issued.
3. AISC "Specification for Architecturally Exposed Structural Steel".
4. AISC's "Seismic Provisions for Structural Steel Buildings".
5. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
6. AWS D1.1 Structural Welding Code.
7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
9. SSPC (Steel Structures Painting Council), Painting Manuals, Volumes 1 and 2.
10. UL Fire Resistance Directory.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Prepare submittal documents including connection design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located, employed by the steel fabricator.

B. Design all structural steel framing connections complying with specified performance:
1. Load Capacity: Resist loads indicated on drawings or resist full capacity of supported framing member if reaction not indicated. Account for connection and member loads and eccentricities.
   a. Request additional design criteria when necessary to complete connection design.
2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the design professional in charge of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the design professional in charge. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

C. Construction: System as indicated on Drawings.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.
8. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. At full penetration welds, Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Qualification Data: For qualified installer, fabricator, and testing agency.
2. Welding certificates.
3. Mill test reports for structural steel, including chemical and physical properties.
4. Product Test Reports: For the following:
   a. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   b. Direct-tension indicators.
   c. Tension-control, high-strength bolt-nut-washer assemblies.
   d. Shear stud connectors.
   e. Shop primers.
5. Source quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator with a minimum of (5) years of experience that participates in the AISC Quality Certification Program for Category I or higher structures and is designated and is designated an AISC-Certified Plant, Category STD. An otherwise qualified fabricator who is not a member of the AISC Quality Certification Program will be accepted if satisfactory evidence of qualifications is submitted prior to award of Contract. For non-certified fabricators, Contractor shall submit a resume describing plant size, equipment quality control procedures and personnel, and experience on comparable work in the last five (5) years.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
1. W-Shapes: 60 percent.
2. Channels, Angles, M, S-Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.

5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

B. W-Shapes: Refer Structural General Notes.

C. Channels, Angles, M, S-Shapes: Refer Structural General Notes.

D. Plate and Bar: Refer Structural General Notes.

E. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, Grade 50.

F. Cold-Formed Hollow Structural Sections: Refer Structural General Notes.

G. Steel Pipe: Refer Structural General Notes.
1. Weight Class: See Plans.
2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers (All bolts located in Crawl Space): ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain or Mechanically deposited zinc coating, where required.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, See Anchor Bolt Schedule on Drawings for Grade.
1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish:
   a. General Condition – Plain
   b. Crawl Space - Hot-dip zinc coating, ASTM A 153, Class C.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

I. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Amscot Structural Products Corp.
      b. Fluorocarbon Company Limited.
      c. R.J. Watson Bridge & Structural Engineered Systems.
      d. Seismic Energy Products, L.P.
   2. Mating Surfaces: PTFE and PTFE or mirror-finished stainless steel.
   3. Coefficient of Friction: Not more than 0.05.
   4. Design Load: Not less than 5,000 psi .
   5. Total Movement Capability: 2 inches.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer (General): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Primer (Crawl Space Steel): Tnemec Perimeprime Series 394.

D. Galvanizing Repair Paint: SSPC-Paint 20.

2.4 GROUT

A. Refer Section 03 30 00.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in final approved Shop Drawings.
   1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other effects.
3. Camber structural steel members where indicated. The camber specified is the camber that is measured in the field with the beam on its side so that the beam weight has no effect. During shipment and handling, cambered members shall be supported in a way that will not result in loss of camber.
4. Camber tolerance
   a. Beams 50 feet and less; plus or minus 1/2 inch.
   b. Beams greater than 50 feet; plus or minus 1/2 inch, except tolerance can be increased 1/8 inch for each 10 feet or fraction thereof in excess of 50 feet.
   c. Contact engineer for members outside specified camber tolerance. Provide engineer with a list of beam locations and actual measured camber amounts. Submit an engineered shoring plan, if requested, that will allow the beam to deflect to the horizontal position after concrete placement without overloading the framing below.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.
1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes by burning.

I. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Base plates hole sizes for anchor bolts may be oversized to facilitate erection:
1. Bolts 3/4inch to 7/8 inch diameter: 1/2 inch oversize.
2. Bolts 1 inch to 1 1/2 inch diameter: 3/4 inch oversize.
3. Bolts over 1 3/4 inch diameter: 1 inch oversize.

J. Base Plate Washers: Sizes shall be as follows:
1. 3/4 inch diameter Bolts: 2 inch diameter x 1/4 inch thick
2. 7/8 inch diameter Bolts: 2 1/2 inch diameter x 5/16 inch thick
3. 1 inch diameter Bolts: 3 inch diameter x 3/8 inch thick
4. 1 1/4 inch diameter Bolts: 3 inch diameter x 1/2 inch thick
5. 1 1/2 inch diameter Bolts: 3 1/2 inch diameter x 1/2 inch thick

6. 1 3/4 inch diameter Bolts: 4 inch diameter x 5/8 inch thick
7. 2 inch diameter Bolts: 5 inch diameter x 3/4 inch thick

K. Architecturally Exposed Structural Steel (AESS): Fabricate with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Specification for Architecturally Exposed Structural Steel" for architecturally exposed structural steel.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, Pretensioned, or Slip critical as required or indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8, where required, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing) excluding crawl space steel. Crawl space steel shall be primed regardless of whether it is to receive fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Crawl space steel to be primed to a DFT between 2.5 and 3.5 mils.

F. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels and shelf angles attached to structural steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Refer Section 01 45 23.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations, to elevations indicated, and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

SECTION 052100 - STEEL OPEN WEB JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH- and DLH-series long-span steel joists.
5. CJ-series composite steel joists.
6. Joist girders.
7. Joist accessories.
    a. Extended ends.
    b. Ceiling extensions.
    c. Bearing plates.
    d. Bridging.
    e. Side wall anchors.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete".
2. Section 01 45 23 “Testing and Inspection Services”
3. Section 04 20 00 "Unit Masonry".
4. Section 05 12 00 "Structural Steel Framing".
5. Section 05 31 13 “Steel Floor Decking”.
6. Section 05 31 23 “Steel Roof Decking”.

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 Structural Welding Code
2. SJI “Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders”.
3. SDI “Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution”.
4. SSPC Steel Structures Painting Council Painting Manual.
5. UL Fire Resistance Directory.
6. ICBO Product Evaluation Reports.
7. FM Roof Assembly Classifications.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Laboratory Test Reports for Credit EQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:
1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. Shop drawings containing special joists shall be submitted with a design load summary for each special joist design. Load summary will be reviewed and returned with the joist submittal. Shop drawings containing special joists submitted without the specified load summary will be returned unchecked as an incomplete submittal. Shop drawings containing special joists shall be signed and sealed by the qualified professional engineer responsible for the design of the joists.

1.6 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Qualification Data: For manufacturer.
2. Welding certificates.
3. Manufacturer certificates.
4. Mill Certificates: For each type of bolt.
5. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.9 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and or masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
   1. Use ASD; data are given at service-load level.
   2. Design special joists to withstand design loads with live-load deflections no greater than the following:
      a. Floor Joists: Vertical deflection of 1/360 of the span.
      b. Roof Joists: Vertical deflection of 1/360 of the span.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.2 MATERIALS

A. Steel: Comply with SJI’s “Specifications” for chord and web members.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions and Extended Ends: Provide top chord extension or extended ends where shown on plans. Design for load indicated on plans.

E. Camber joists according to SJI's Specifications unless noted otherwise.

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on plan.
   1. Joist Type: Refer to Drawings.
   2. End Arrangement: Refer to Drawings.
   3. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated on plan.
   1. End Arrangement: Refer to Drawings.
   2. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joist girders.

C. Camber joist girders according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 PRIMERS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.7 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint for interior exposure or Hot-dip zinc coat according to ASTM A 123/A 123M for exterior or weather exposure.

C. Furnish ceiling extensions (where indicated), either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Plain, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

G. Galvanizing Repair Paint: ASTM A 780.

H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1.5 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications", "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework as indicated on Drawings. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance, and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using high-strength structural bolts as indicated on Drawings. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

3.4 REPAIR AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 053113 - STEEL FLOOR DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Composite floor deck.
2. Electrified cellular floor deck.
3. Noncomposite form deck.
4. Noncomposite vented form deck.

B. Related Requirements:
1. Section 01 45 23 “Structural Testing and Inspection Services”.
2. Section 03 30 00 "Cast-in-Place Concrete".
3. Section 05 12 00 "Structural Steel Framing".
4. Section 05 21 00 “Steel Open Web Joist Framing”
5. Section 05 50 00 "Metal Fabrications".

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 - Structural Welding Code
2. AWS D1.3 – Structural Welding Code – Sheet Steel
3. SDI – Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.
4. SSPC – Painting Manual
5. UL – Fire Resistance Directory
6. ICBO – Product Evaluation Reports

1.4 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Laboratory Test Reports for Credit EQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Welding certificates.
2. Product Certificates: For each type of steel deck.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
4. Power-actuated mechanical fasteners.
5. Evaluation Reports: For steel deck.
6. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: As indicated in Structural General Notes.
2. Profile Depth: As indicated on plan.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.

2.3 ELECTRIFIED CELLULAR FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. CMC Joist & Deck.
2. Consolidated Systems, Inc.; Metal Dek Group.
3. Cordeck.
4. HH Robertson Floor Systems; a CENTRIA company.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.
8. Verco Manufacturing Co.
9. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

C. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from single manufacturer.

D. Electrified Cellular Floor Deck: Fabricate steel-sheet cellular floor-deck panels, consisting of a ribbed top section welded to a lower flat-bottom sheet with interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck" in SDI Publication No. 31. Fabricate deck to the minimum section properties, width of panel, number and area of cells per panel indicated, and the following:

1. Cellular Deck Type: Composite.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
3. Profile Depth: As indicated on plan.
4. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
5. Span Condition: Triple span or more.
6. Factory punch holes, of size and arrangement indicated, into each deck cell at preset inserts and header duct locations.

2.4 NONCOMPOSITE FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Group.
10. Roof Deck, Inc.
11. Valley Joist; Subsidiary of EBSCO Industries, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 80 minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard Gray.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 80, G90 zinc coating.
3. Profile Depth: As indicated on Plan.
4. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.5 NONCOMPOSITE VENTED FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.

8. Roof Deck, Inc.
9. Verco Manufacturing Co.
10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Vented Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 80, G60 zinc coating.
2. Profile Depth: As indicated on Plan.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1.5 percent open area.

2.6 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated on Drawings.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Space and locate welds as indicated on Drawings.
3. Weld Washers: Install weld washers at each weld location where deck is 22 gage or less.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch only with concrete filled decks.
   3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Revise "Floor-Deck Closures" Paragraph below to suit Project. Sealing cellular deck openings, butt joints, and junctions with trench headers with tape is not included in this Section. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Electrified Cellular Floor Deck: Install cellular floor system with deck assembled from units indicated.
   1. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Section 260539 "Underfloor Raceways for Electrical Systems" with installation of electrified cellular metal floor deck.

G. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.4 COMPOSITE FLOOR DECK INSTALLATION

A. The composite steel deck shall be connected to the supporting steel beams by welding the shear/headed stud connectors through the deck as indicated in the drawings. Contractor to verify the attachment of the deck to the supporting member after the headed stud is welded. Improper amperage may cause burn through around the stud and the deck may not be adequately attached to the supporting deck.

B. Where shear/headed stud connectors are not specified, the metal deck shall be attached to the supporting steel with 3/4-inch diameter puddle welds at a maximum spacing of 12 inches.

C. Where the specified shear/headed stud connector spacing exceeds 12 inches, provide 3/4-inch diameter puddle welds between shear/headed stud connectors to maintain a maximum deck connection of 12 inches.

D. Where deck units abut side to side or end to end over a supporting member provide 3/4-inch diameter puddle welds on each deck unit at a maximum spacing of 12 inches.

E. Shear/Headed Stud Connectors: Field weld shear/headed stud connectors through deck to supporting frame according to AWS D1.1 and manufacturer’s written instructions. Located connectors as indicated in the drawings. Remove and discard arc shields after welding shear/headed stud connectors.

3.5 DECK AND FLOOR DEFLECTION

A. The metal deck is designed to deflect up to 3/4-inch.

B. Uncambered steel beams are designed to be within code required deflection limits (Span/240). Cambered steel beams are designed to have a final deflected shape of less than 1/2-inch. Due to field tolerances and camber tolerances, these design limits may be slightly exceeded.

C. The contractor shall account for any additional concrete required due to these deflected shape tolerances.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Refer Section 01 45 23.

B. Remove and replace work that does not comply with specified requirements.

C. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.7 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 13

SECTION 05 31 23 - STEEL ROOF DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Roof deck.
2. Acoustical roof deck.
3. Noncomposite vented roof deck.

B. Related Requirements:
1. Section 01 45 23 “Structural Testing and Inspection Services”
2. Section 05 12 00 "Structural Steel Framing".
3. Section 05 50 00 "Metal Fabrications".

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standard referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 – Structural Welding Code
2. AWS D1.3 – Structural Welding Code – Sheet Steel
3. SDI – Design Manual
4. SSPC – Painting Manual
5. UL – Fire Resistance Directory
6. ICBO – Product Evaluation Reports
7. FM – Roof Assembly Classifications

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G90 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
4. Deck Profile: As indicated on plan.
5. Profile Depth: As indicated on plan.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Span Condition: Triple span or more.
8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.

9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Deck Profile: As indicated in Structural General Notes.
4. Cellular Deck Profile: As indicated in Structural General Notes.
5. Profile Depth: As indicated in Structural General Notes.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
8. Span Condition: Triple span or more.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.
10. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
11. Sound-Absorbing Insulation: Manufacturer's standard pre-molded roll or strip of glass or mineral fiber.
   a. Factory install sound-absorbing insulation into cells of cellular deck.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
   1. Fasteners shall provide diaphragm shear and uplift resistance equal to or greater than welding indicated herein and on Drawings.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: As indicated on Structural Plans.
   2. Weld Spacing: As indicated on Structural Plans.
   3. Weld Washers: Install weld washers at each weld location if deck gauge is lighter than 22 gauge.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals shown on Structural Plans:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 23

SECTION 054000 – COLD-FORMED METAL FRAMING

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 including but not limited to:
1. Load bearing wall framing.
2. Exterior nonload bearing wall framing.
3. Floor joist framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.
7. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications.

B. Section 09 21 16 – Gypsum Board.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Texas, to design cold formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: Indicated on Structural Drawings.
2. Coordinate the requirements on the Structural Drawings with the requirements of this Section. If a conflict exists, notations on the Structural Drawings take precedence.
3. The following document governs the Work, except where more restrictive items are specified:
AISI Design of Cold-Formed Steel Structural Members Wind Load
Minimum Design Loads
    1. As required by code officials having jurisdiction.
    2. Deflection: 1/600 for clear simple spans
    3. Deflection: 1/300 for cantilever conditions and roof parapets
    4. Gauge: 16 gauge minimum, unless noted otherwise.

4. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
5. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
6. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

7. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (67 degrees C).
8. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
   a. Upward and downward movement of 1-1/2 inches (38 mm).

9. Design exterior nonload bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold Formed Steel Framing Design Standards:
1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

1.5 SUBMITTALS

A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.

B. Shop Drawings: Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
1. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas. Calculations must show design will with stand wind loading commiserate with class and rating of the project.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Welding Qualifications: Qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M Structural Welding Code - Steel.
   b. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.

2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions.
   a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
   b. Comply with AISI S230 Standard for Cold Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings.

3. Fire Resistance Ratings: ASTM E 119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory*.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas and who is experienced in providing engineering services of the

kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent.

1. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and structural data.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CEMCO; California Expanded Metal Products Co.
2. ClarkDietrich Building Systems.
3. Consolidated Fabricators Corp.; Building Products Division.
4. Marino\WARE.
5. SCAFCO Corporation.
6. The Steel Network.

2.2 EXTERIOR NONLOAD BEARING WALL FRAMING

A. Steel Studs: C shaped steel studs, of web depths indicated, punched, with stiffened flanges:
1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: Refer to the Drawings.

B. Steel Track: U shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AllSteel & Gypsum Products, Inc.
b. ClarkDietrich Building Systems.
c. Marino\WARE.
d. SCAFCO Corporation.
e. Simpson Strong-Tie Co., Inc.
f. Steel Network, Inc. (The).
g. Steeler, Inc.

D. Single Deflection Track: Single, deep leg, U shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:

1. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
2. Flange Width: 1 inch (25 mm) plus the design gap for one story structures and 1 inch (25 mm) plus twice the design gap for other applications.

E. Double Deflection Tracks: Double, deep leg, U shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
a. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
b. Flange Width: 1 inch (25 mm) plus the design gap for one story structures and 1 inch (25 mm) plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated:
a. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
b. Flange Width: 1 inch (25 mm) plus the design gap for one story structures and 1 inch (25 mm) plus twice the design gap for other applications.

F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.3 SOFFIT FRAMING

A. Exterior Soffit Frame: C shaped steel sections, of web depths indicated, with stiffened flanges:
1. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm) minimum.

2.4 FRAMING ACCESSORIES

A. Fabricate steel framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

C. Anchors, Clips, and Fasteners:
1. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot dip process according to ASTM A 123/A 123M.
2. Expansion Anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

3. Power Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
4. Mechanical Fasteners: ASTM C 1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws.
   a. Head Type: Low profile head beneath sheathing.

5. Welding Electrodes: Comply with AWS standards.

D. Miscellaneous Materials:
1. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM A 780.
2. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30 minute working time.
3. Shims: Load bearing, high density multimonomer plastic, and nonleaching; or of cold formed steel of same grade and coating as framing members supported by shims.
4. Sealer Gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.5 FABRICATION

A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements.
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.

C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

A. General:
1. Track Anchors: Install anchors maximum 4 feet - 0 inches on center; design anchors and spacing to carry live, dead and wind loads.
2. Track Splices: Provide channel inserts or weld track splices.
3. Erection: Install members plumb, level, and in a true plane.
4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.

B. Install metal framing systems in accordance with stud manufacturer's printed instructions.

C. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align tracks accurately to layout at base and tops of studs.
3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
4. Provide fasteners at corners and ends of tracks.
5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
6. Provide Deflection Track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2 inch movement of primary structure. Do not attach studs directly to Deflection Track.
7. Vertical Deflection Clips: Provide manufacturer’s standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure

D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."

E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum 2 feet on center vertical.

G. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.

I. Install bracing/bridging in accordance with manufacturer’s instructions and design conditions.

J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.

K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

END OF SECTION 05 40 00

SECTION 055000 - METAL FABRICATIONS

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 including but not limited to:
1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors and grilles.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Shelf angles.
7. Metal ladders.
8. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading dock edge angles.
9. Metal bollards.
10. Sidewalk trench drain covers and frames.
11. Accessories necessary for a coordinated and complete installation.

1.3 DEFINITIONS

A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, 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.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders and countertop supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

D. Structural Performance:

1. Countertops and Vanities: Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
   a. All dead loads.
   b. 500 pound live load placed on the countertop and vanity.
   c. Deflection at Midspan: L/1000 times span or 1/8 inch whichever is less.

E. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 SUBMITTALS

A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.

B. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   1. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the IBC for metal fabrications.
   2. Welding: Qualify procedures and personnel according to the following:
      a. AWS D1.1/D1.1M Structural Welding Code - Steel.
      b. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
      c. AWS D1.6/D1.6M Structural Welding Code - Sheet Steel.
      d. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of 5 years, with a record of successful in service performance, with sufficient production capacity to produce required units without causing delay in the work.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind

indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.8 STORAGE, DELIVERY AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle so as to prevent any type of damage to the fabricated work.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.

E. Rolled Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

F. Rolled Stainless Steel Floor Plate: ASTM A 793.

G. Abrasive Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. IKG Industries, a division of Harsco Corporation.
      b. SlipNOT Metal Safety Flooring; W.S. Molnar Company.

H. Steel Tubing: ASTM A 500/A 500M, cold formed steel tubing.

I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Zinc Coated Steel Wire Rope: ASTM A 741.
   1. Wire Rope Fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 inches by 1-5/8 inches (41 mm by 41 mm).
   2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B. with G90 (Z275) coating; [0.108 inch (2.8 mm) nominal thickness.
   3. Cold Formed Metal Channels: Flange edges returned toward web and with 9/16 inch (14.3 mm) wide slotted holes in webs at 2 inches (51 mm) o.c.
   4. Width of Channels: 1-5/8 inches (41 mm).
   5. Depth of Channels: Indicated on Drawings.
   6. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108 inch (2.8mm) nominal thickness.
   7. Finish: Hot dip galvanized after fabrication.

L. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

M. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

N. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

O. Aluminum Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

P. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

Q. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

R. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

S. Fasteners: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum.
   2. Provide stainless steel fasteners for fastening stainless steel.
   3. Provide stainless steel fasteners for fastening nickel silver.
   4. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   5. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
   6. Stainless Steel Bolts and Nuts: Regular hexagon head annealed stainless steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy.
   7. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

a. Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

8. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
9. Cast in Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F 2329.
10. Post Installed Anchors: Torque controlled expansion anchors or chemical anchors.
    a. Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
    b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

11. Slotted Channel Inserts: Cold formed, hot dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

T. Miscellaneous Materials:
1. Shop Primer for Ferrous Metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
2. Universal Shop Primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
3. Water Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
4. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous Paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187 ASTM D 1187/D 1187M.
7. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete Materials and Properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8” with at least 95 % passing a 3/8” sieve and not more than 10% passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28 day compressive strength of 3000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Form exposed work with accurate angles and surfaces and straight edges.
4. Weld corners and seams continuously to comply with the following:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.
   d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
8. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
9. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

B. Miscellaneous Framing and Supports: Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to framing and supports for elevator hoistway beams, elevator sills, overhead lobby door frames, sliding doors, countertop and vanities, and tube framing for partial height walls, CMU partition head supports, mechanical and electrical equipment.
   1. Fabricate units from 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. Cut, drill, and tap units to receive hardware, hangers, and similar items.
      a. Fabricate units from slotted channel framing where indicated.
      b. Furnish inserts for units installed after concrete is placed.

   2. Operable Partitions: Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
   3. Countertop and Vanity Framing: Custom fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.

4. CMU Partition Head Supports: Fabricate supports from 4" x 4" x 1/4" x 36" (100 mm by 100 mm by 6 mm by 900 mm) long structural steel angles. Drill supports a maximum of 12 inches (300 mm) o.c. to receive expansion bolts.
5. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.
6. Steel Pipe Columns: Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
    a. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
    b. Unless otherwise indicated, provide 1/2 inch (12.7 mm) baseplates with four 5/8 inch (16 mm) anchor bolts and 1/4 inch (6.4 mm) top plates.
    c. Galvanize miscellaneous framing and supports.

C. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4 inch (19 mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
3. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
4. Galvanize and prime shelf angles located in exterior walls.
5. Prime shelf angles located in exterior walls with zinc rich primer.
6. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast in place concrete.

D. Ladders: Comply with ANSI A14.3. For elevator pit ladders, comply with ASME A17.1/CSA B44.
1. Steel Ladders:
    a. Space siderails16 inches (406 mm) apart unless otherwise indicated.
    b. Siderails: Continuous, 3/8 inch by 2-1/2 inch (9.5 mm by 64 mm) steel flat bars, with eased edges.
    c. Rungs: 1 inch (25 mm) square steel bars.
    d. Fit rungs in centerline of siderails; plug weld and grind smooth on outer rail faces.
    e. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive or by using a type of manufactured rung filled with aluminum oxide grout.
    f. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
        1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
            a) Harsco Industrial IKG, a division of Harsco Corporation.
            b) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

    g. Provide platforms as indicated fabricated from welded or pressure locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
    h. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
    i. Galvanize ladders, including brackets and fasteners.

2.3 MISCELLANEOUS STEEL TRIM

A. Miscellaneous Steel Trim: Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
   1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
      a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c.

   2. Cast in Pit Angles and Edge Angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.
   3. Galvanize miscellaneous steel trim.

2.4 PIPE BOLLARDS

A. Pipe Bollards: Fabricate metal bollards from Schedule 40 steel pipe or 1/4 inch (6.4 mm) wall thickness rectangular steel tubing.
   1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
   2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
   3. Where installation on structural slab or existing paving.
   4. Fabricate bollards with 3/8 inch (9.5 mm) thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4 inch (19 mm) anchor bolts.
      a. Where bollards are anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

   5. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4 inch (6.4 mm) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.5 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).

D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).

E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.6 FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surfaces.

2.7 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. C. Stainless Steel Finishes: Remove tool and die marks and stretch lines or blend into finish.
   1. a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
   2. b. Bright, Directional Polish: No. 4 finish.
   3. c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.8 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
   1. 1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

2.9 MISCELLANEOUS METAL ITEMS

A. Sidewalk Trench Covers and Frames: Provide trench covers and frames at sidewalks where shown on drawings or required. Approved Product/Manufacturers: Type TGLB-10 as manufactured by McKinley Iron Works, Fort Worth, Texas; (800) 792-2273; Barrycraft Pedestrian-Handicap/Bicycle Trench Grating B-PED-A2 as manufactured by Barry Pattern & Foundry Company, Inc. Birmingham, Alabama (800) 524-1809; or Architect approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports securely to, and rigidly brace from, building structure.
   1. CMU Partition Head Supports: Unless otherwise indicated place partition head supports on alternate faces of CMU partitions every 6 feet o.c. and expansion bolt to underside of structure. Do not bolt to CMU partitions.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.steel

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.5 ADJUSTING AND CLEANING

D. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

E. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00.

F. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Blocking in wall and roof openings.
   2. Wood furring and grounds.
   3. Concealed wood blocking for support of toilet accessories, wall cabinets, handrails, and other wall-mounted items.
   4. Telephone and electrical panel back boards.
   5. 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:
1. AWPA U1, Use Category UC2; using inorganic boron (SBX) preservative with 0.25 percent retainage.
2. ASPA U1, Use Category UC2 and UC3; using Micronized Copper Azole (MCA) preservative, retention in accordance with AWPA U1.

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. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 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.

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.

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 31 13 – Project Coordination: 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 new or existing interior concrete floors scheduled 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 81 19 – Project Meetings: 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 77 00 – Closeout Procedures: 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. Sika; usa.sika.com
C. W.R. Meadows; www.wrmeadows.com
D. Substitutions: Section 01 25 00 – Substitution Procedures.

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: *Scofield Selectseal Plus* as manufactured by Sika.
2. VOC Content: less than 100 g/L.
3. Semi-Gloss or Gloss finish as selected.
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 31 13 – Project Coordination: 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 any curing agents remaining on surface of new 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 or curing agent 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 77 00 – Closeout Procedures: 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.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Cavity wall construction.
   2. Section 07 27 26 – Fluid-Applied Membrane Air Barrier: Substrate.
   3. Section 09 21 16 – Gypsum Board Assemblies: Gypsum sheathing substrate.

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 documentation that the proposed total R-value meets the requirements of ASHRAE 90.1 for project building zone per International Building Code.
   4. 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 81 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. Dow Chemical Company. www.dow.wom/en-us
   2. Owens Corning. www.owenscorning.com
   3. CertainTeed Corporation. www.certainteed.com
   4. Knauf Insulation. www.knaufinsulation.com
   5. Substitutions: Section 01 25 00 – Substitution Procedures.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 Project Coordination: Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which the work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

C. Verify all debris has been cleared from wall cavity.

D. 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.

E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

F. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: 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 07 21 13 “Thermal Wall Insulation” for wall insulation compatibility.
2. 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 10-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. Polyguard Products, Inc. *Airlok Flex VP-40*
4. Prosoco R-Guard Spray Wrap.
5. Sika Corporation: *Sikagard 530*
6. STO: *Emerald Coat*.
7. TK Products, Inc. *TK AirMax2104*
8. Tremco, Inc.: *ExoAir 220.*
9. W.R. Meadows, Inc.: *Air Shield LMP.*
10. Substitutions: Section 01 25 00 – Substitution Procedures.

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 10.0 US 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 31 13 – Project Coordination: 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.
4. Make frequent wet mil thickness measurements as required during application to ensure application thickness will yield specified dry mil thickness requirements.

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 52 00 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: SBS Modified bitumen light-reflecting (“Cool Roof”) membrane roofing installed over insulating concrete roof fill.

B. Related Sections:
1. Section 03 52 16 – Insulating Concrete Roof Fill.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings, counter flashings, fascia and copings.
3. Section 07 71 00 - Roof Specialties.
4. Section 07 72 33 – Roof Hatches.

1.2 REFERENCES

A. ASTM International:
1. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
2. ASTM D312 - Standard Specification for Asphalt used in Roofing.
3. ASTM D6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
4. ASTM D6298 - Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet with a Factory Applied Metal Surface.
5. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

B. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.

1.3 SYSTEM DESCRIPTION

A. BASIC COMPONENTS
1. Two-plies SBS modified bituminous membrane set in hot asphalt over base sheet mechanically attached to insulating concrete roof fill.
2. Reflective white finish and foil-faced base flashing.
3. Meet requirements of NRCA Specification Plate: MBS-3-N-M-M.

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift: In accordance with ASCE-7 requirements.

B. Roof Surface: Provide finished roofing membrane with minimum total solar reflectance of 0.7 and thermal emittance greater than 0.8 when tested in accordance with the following:
1. Reflectance: Measured in accordance with ASTM C1549-02, ASTM E903, or ASTM E1918.
2. Emittance: Measured in accordance with ASTM C1371, or ASTM E408.

C. Flashings and Fastening: Comply with requirements of Section 07 62 00 - Sheet Metal Flashing and Trim. Provide base flashings, perimeter flashings, detail flashings and

component materials and installation techniques that comply with requirements and recommendations of the following:

1. ANSI/SPRI ES-1 for Perimeter detail, metal edges and copings, as a minimum design requirement.
2. NRCA Roofing and Waterproofing Manual for construction details and recommendations.
3. SMACNA Architectural Sheet Metal Manual for construction details; latest edition.
4. All sheet metal shall comply as a minimum design requirement.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data for each product specified, including membrane materials, base flashing materials, asphalt, fasteners, cants and accessories.

C. Samples: Submit two samples of each of the following:

1. 12 x 12 inch samples of each membrane product, including coated membrane.
2. 12 x 12 inch sample of walkway pad.
3. 4 fasteners of each type, length, and finish.

D. Manufacturer's Installation Instructions: Submit manufacturer’s standard installation instructions and details, modified to reflect conditions specific to this installation.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

F. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Manufacturer's Field Reports: Indicate procedures followed, and ambient temperatures and wind velocity during application.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Roof Assembly Fire Classification: Class A when tested in accordance with ASTM E108 or UL 790.

C. Furnish materials from a single manufacturer for all roof surfaces.

1.7 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.

C. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meetings.

B. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the pre-installation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

C. Pre-installation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Stand roll materials on end.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply roofing membrane during inclement weather without proper weather protection. Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's instructions and warranty requirements.

C. Do not apply roofing membrane to damp or frozen deck surface.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.12 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Manufacturer's No Dollar Limit (NDL) warranty, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, fasteners, and walkway products and other components of roofing system.
2. Warranty Period: 20-years from date of Substantial Completion.

C. Installer’s Warranty: Submit Roofing Installer's Warranty, on warranty form at end of this Section: signed by Installer, covering all Work of this Section including all roofing system components such as roofing membrane; base flashing; metal flashing including counter flashing, roof edging and coping; fasteners; adhesives; and walkway products, for the following warranty period(s):
1. Warranty Period: Five-years from date of Substantial Completion of Project.

PART 2 PRODUCTS

2.1 MODIFIED BITUMINOUS ROOFING

A. Manufacturers:
1. Johns Manville; www.jm.com
2. Siplast; www.siplast.com
3. Soprema; www.soprema.com.
4. Elevate by Holcim; www.holcimelevate.com/us-en
5. Substitutions: No substitutions.

2.2 COMPONENTS

A. Nailed Base Sheet: ASTM D4601 Type II, non-porous, glass fiber-reinforced base sheet, 45 mils thick.

B. Base Ply Membrane: ASTM D6163; Type I, Grade S, styrene-butadiene-styrene (SBS) modified bituminous sheet, reinforced with glass fiber; smooth surfaced; 120 mils thick. Soprema “Elastophene” sanded.

C. Finish Ply Membrane: ASTM D6163; Type I, Grade G, SBS modified bituminous sheet, reinforced with glass fiber; reflective white ceramic granules; minimum 155 mils thick. Soprema “Elastophene” FRGR. Contractor option for installation. System can be torched or fully adhered.

D. Stripping Ply: Same as modified bitumen base ply.

E. Modified Bitumen Flashing Sheet: ASTM D6298; SBS modified bituminous sheet, reinforced with glass fiber; channel-embossed aluminum foil surfaced; 150 mils thick. Soprema “Sopralast 50 TV Alu”. “Cool Roof” reflective white finish.

F. Roof Surface: Minimum total solar reflectance of .70 and thermal emittance of.75 when tested in accordance with the following:
1. Reflectance: Measured in accordance with ASTM C1549, ASTM E903, ASTM E1175, or ASTM E1918.

2. Emittance: Measured in accordance with ASTM C835, ASTM C1371, or ASTM E408

G. Roofing Adhesives:
1. Mopping Asphalt: Asphalt that has been certified for full compliance with the requirements for Low Fume Type IV asphalt listed in Table I, ASTM D312. Each container or bulk shipping ticket shall indicate the equiviscous temperature EVT, the finished blowing temperature FBT, and the flash point FP.
a. Trumbull Low Fume asphalt.
b. Equal product as approved by membrane manufacturer.
2. Cold Adhesive - Soprema “FMA”: An asphalt-based adhesive formulated especially for adhering polymer modified asphalt roofing membranes and base plies, UL and FM listed.

H. Counter-flashings: As specified in Section 07 62 00.

2.3 ACCESSORIES

A. Wood Nailers and Structural Cants: Treated wood complying with local area Fire Marshal requirements and Division 6 Section "Rough Carpentry."

B. Ceramic Granules: No. 11 Grade Specification ceramic granules of color matching granule surfacing of the finish ply.

C. Fasteners:
1. Base Sheet Fasteners: Electro zinc coated steel with 2.7 inch diameter rib-reinforced cap and 1.7 inch long rectangular legs designed to spread when full driven into the lightweight insulating concrete. Meet FM Standard 4470 requirements for corrosion resistance. Olympic Fasteners or equivalent approved by the membrane manufacturer.
2. Flashing Nails: G-90 galvanized or non-ferrous type. Type 304 stainless steel for ACQ treated lumber fastening. Sizes as required for the particular application. Minimum 11-gauge with 3/8” diameter head.

D. Sealants: Single component, high performance elastomeric sealant conforming to ASTM D232 or ASTM C920 requirements, and as approved by membrane manufacturer.

E. Traffic Pads: Bituminous composition, granule finish. Soprema “Soprawalk”.
1. Walk pads shall have contrasting granule color from membrane surfacing.

F. Insulation Cant Strips: ASTM C 728, perlite insulation board.

G. Bituminous Cutback Materials:
1. Primer: A high flash, quick drying, asphalt solvent blend. Meets or exceeds ATM D41 requirements.
2. Plastic Cement: Asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D4586, Type II requirements.
3. Flashing Cement: heavy bodied all weather towel grade mastic, used as a base for laying-up cold process flashing membrane where fast setting adhesives are required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces and site conditions are ready to receive work.

C. Verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains valleys, or eaves.

D. Verify deck surfaces are dry and free of snow or ice. Confirm that deck moisture content is acceptable to roofing manufacturer.
   1. Foaming Test: Heat one pint of specified bitumen to 350 degrees F and pour on surface to receive roofing membrane. If bitumen foams, deck is too wet to roof.
   2. Stripability Test: Cool bitumen poured on deck to ambient temperature and strip from surface. If any portion strips cleanly from deck, surface is too wet to roof.
   3. Retest for dryness after any rain.

E. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set; and wood cants, nailers, and sheathing are in place.

3.2 PREPARATION

A. Clean deck of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with roofing system manufacturer's written instructions and NRCA recommendations.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24), install roofing membrane sheets parallel with slope.

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 degrees F of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

G. Substrate Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 CANT STRIPS

A. Fiber Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.

B. Use treated wood cant strips where fiber cants are required for structural support of curbs and wood nailers, or where required by the membrane manufacturer.

3.5 MEMBRANE INSTALLATION

A. Base Sheet – Over Insulating Concrete Roof Fill:
1. Beginning at low point of roof, install one ply base sheet over lightweight insulating concrete roof deck, lapping sides a minimum of 3 inches and ends a minimum of 6 inches.
2. Mechanically-fasten base sheet to roof deck in fastening pattern approved by the roofing membrane manufacturer and as required to achieve specified wind uplift rating.

B. Base Membrane Ply: Install one base membrane ply in solid mopping of hot asphalt applied at not less than 425 degrees F, starting at low point of roofing system.
1. Lap sides and ends a minimum of 3 inches. Offset end joints a minimum of 3 feet.
2. Extend base ply over roof edges and down walls a minimum of 4 inches.

C. Finish Membrane Ply: Torch apply or fully adhere one finish membrane ply, starting at low point of roofing system.
1. Lap sides and ends a minimum of 3 inches. Offset end joints a minimum of 3-feet. Stagger laps from base ply laps.

D. Lap and seal edges and ends permanently waterproof.

E. Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate.

F. Mop and seal membrane around base ply roof protrusions and penetrations. Seal around finish ply roof protrusions and penetrations.

G. Provide waterproof cut-off to membrane at end of day's operation. Remove cut-off before resuming roofing.

3.6 FLASHINGS AND ACCESSORIES:

A. Prior to installing final membrane ply, strip in metal flanges of embedded flashings, and reinforce inside corners at parapets, walls, and curbs with base ply membrane.
1. At roof edges, extend stripping a minimum of 4 inches beyond edge of flashing onto roof surface.
2. At parapets and walls, extend stripping a minimum of 4 inches beyond toe of cant onto roof surface and 3 inches above top of cant onto vertical surface.
3. At curbs and penetrations, extend stripping a minimum of 4 inches beyond edge of flashing onto roof surface.

B. Install base flashing over final membrane ply at roof edges, transitions to vertical surfaces, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions.
1. Prime substrates with asphalt primer if required by roofing system manufacturer.

2. Base Flashing Application: Adhere flashing sheet to substrate in a solid mopping of hot asphalt or roofing cement. Apply asphalt or roofing cement to back of flashing sheet if recommended by roofing system manufacturer.
3. Extend base flashing up vertical surfaces a minimum of 8 inches above roof surface.
4. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
    a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

C. Roof Drains: Set 30 x 30 inch metal flashing in bed of asphalt roofing cement on installed base ply membrane. Cover metal flashing with base ply membrane stripping and extend a minimum of 4 inches beyond edge of metal flashing onto field of roofing membrane. Cover with finish ply membrane set in hot asphalt. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
1. Do not set overflow roof drains in sumps. Heights of overflow roof drains shall be established relative to roof plane adjacent to, but outside of, main drain roof sumps.

3.7 TRAFFIC PAD INSTALLATION

A. Traffic Pads: Install traffic pads over roofing membrane in hot asphalt applied at not less than 425 degrees F. Provide open joints at nominal 36” where required to avoid trapping water.

B. Install walk pads at points of roof access, at 36” wide x full length of unit at service sides of all roof mounted equipment requiring periodic maintenance.

C. Install under all pipe supports and in front of all roof top doors and hatches.

D. Seal around perimeter edges of traffic pads in accordance with membrane manufacturer’s recommendations.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Require site attendance of roofing materials manufacturers during installation of the Work.

C. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

D. Test Cuts: Test specimens may be removed to evaluate problems observed during quality-assurance inspections of roofing membrane.
1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

F. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect building surfaces against damage from roofing work.

C. Where traffic must continue over finished roof membrane, protect surfaces.

3.11 ROOFING INSTALLER'S WARRANTY - Installer shall submit warranty prepared using the following format.

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: <Insert name of Owner.>
2. Address: <Insert address.>
3. Building Name/Type: <Insert information.>
4. Address: <Insert address.>
5. Area of Work: <Insert information.>
6. Acceptance Date: <Insert date.>
7. Warranty Period: <Insert time.>
8. Expiration Date: <Insert date.>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
a. lightning;
b. peak gust wind speed exceeding <Insert wind speed> mph;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or

unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

Authorized Signature: <Insert signature.>
Name: <Insert name.>
Title: <Insert title.>

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 not a part of other special systems.
   2. General requirements for flashings and counter flashings provided under this or other sections.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Flashings embedded in masonry.
   2. Section 07 42 13 – Metal Wall Panels: Flashings related to wall panels.
   3. Section 07 90 00 - Joint Protection: Requirements for sealants.

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.
   2. ASTM E1592 - Standard Specification for Structural Performance of Sheet Metal Roof and Siding Systems.
   3. ASTM B32 - Standard Specification for Solder Metal.
   4. 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.

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.

1.4 COORDINATION

A. Meet with the General Contractor/Construction Manager, mason, roofing contractor, wall panel contractor, waterproofing contractor, and other related trades to coordinate to coordinate the flashing materials and installation requirements.

1.5 SUBMITTALS

A. Section 01 33 00 - 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.

1.6 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.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 81 19 – Project Meetings: 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. 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.

1.9 WARRANTY

A. Section 01 77 00 – Closeout Procedures: Product warranties and product bonds.

B. Special Workmanship Warranty: 5-year Contractor workmanship warranty.

C. 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: 30-years from date of Substantial Completion of the Project.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Fascia/Gravel Stop and Visible Copings: Minimum .040" thick formed aluminum with Kynar 500 (70% fluorocarbon) finish and minimum .050" thick formed aluminum **continuous** connector cleat. At joints provide 8" long aluminum joint backer plate with color finish to match fascia.

B. Built-In Metal Flashing: ASTM A240/240M; Type 302/304 stainless steel, dead soft fully annealed; smooth surface, Number 2D finish; minimum 24 gage thick.

C. Galvanized Sheet Steel: Not allowed unless specifically approved in writing by the Architect.

2.2 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers. Match finish of exposed heads with material being fastened.

B. Underlayment at Metal Roofing: 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. Shop-fabricate all work to greatest extent possible.

B. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

C. Fabricate cleats of same material as sheet metal, interlocking with sheet.

D. Form pieces in longest possible lengths.

E. Hem exposed edges on underside 1/2 inch; miter and seam corners.

F. 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.

G. Fabricate corners from one piece with minimum 18 inch long legs; seam and seal prefinished steel, solder stainless steel.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

I. 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.

J. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

K. Fabricate gutters to rectangular profile as indicated on Drawings.

L. Fabricate downspouts to square profile, 4-1/2 x 4-1/2 inch size unless indicated otherwise.

M. 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.

N. Seal metal joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 – Project Coordination: 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 15-mil dry film thickness.

3.3 INSTALLATION

A. Install standing seam metal roofing in accordance with manufacturer’s recommendations and the approved shop drawings, using installers certified by the system manufacturer.

1. Install entry canopy systems cantilevered from masonry walls using system manufacturer’s recommended supports as indicated in the drawings.

2. Install decorative canopy with L-Bent cantilever supports and columns as indicated in the drawings.

B. Install sheet metal flashing and trim in accordance with SMACNA requirements.

C. Secure flashings in place using concealed fasteners wherever possible. Use exposed fasteners only where recommended by the system manufacturer and where not exposed to public view.

D. Install flashings embedded in roofing system in accordance with roofing manufacturer's details and instructions to meet SPRI ES-1 requirements.

E. Install edge flashings in accordance with Section 07 54 05 to meet SPRI ES-1 requirements.

F. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. 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).

H. Secure gutters and downspouts in place.

I. Touch up painting is only allowed for seams and is to be minimally used on-site to prevent rusting. All other color should be shop fabricated and powder coat.

J. Slope gutters minimum 1/8 inch per foot.

K. Seal metal joints watertight.

L. Back-paint all concealed metal surfaces with bituminous paint where in contact with cementitious materials or dissimilar metals.

3.4 SCHEDULE

A. Gutters with Girth up to 20-Inches: Prefinished steel, 24 gage.

B. Gutters with Girth 20 to 25-inches: Prefinished steel, 22 gage.

C. Downspouts: Prefinished steel, 24-gage.

D. Scuppers: Stainless steel, 24-gage.

E. Gravel Stops and Fasciae: Prefinished edge flashings, minimum 24-gage, configuration as indicated on the drawings.

F. Exposed Trim: Prefinished steel, 24-gage.

G. Counterflashings and Receivers: Stainless steel, 24-gage.

H. Roof Expansion Joints: Stainless steel, 24-gage.

I. Equipment Support and Roof Penetration Flashing: Stainless steel, 24-gage.

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. HILTI, Inc., www.us.hilti.com/engineering
c. Nelson Firestop Products
d. Specified Technologies, Inc., www.stifirestop.com
e. USG Corporation, www.usg.com
f. RectorSeal, www.rectorseal.com/
g. 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 31 13 – Project Coordination: 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.

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 between storefront assemblies and adjacent materials.
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 shower pan membrane and below-grade waterproofing systems.
3. Section 07 52 00 – Modified Bituminous Roofing System: Sealant as part of membrane roofing system.
4. Section 07 62 00 – Sheet Metal Flashing and Trim: Sealant as part of metal flashing systems.
5. Section 07 84 00 - Firestopping: Sealant as part of firestopping assemblies.
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 31 13 – Project Coordination: 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 Advanced Materials www.ge.com.
3. BASF. www.basf.com.
4. Sika Corp. www.sikaconstruction.com.
5. Tremco Sealants & Waterproofing www.tremco.com.
6. Pecora. www.pecora.com
7. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 EXTERIOR SEALANTS:

A. General Purpose Exterior (Nontraffic) Sealant: Polyurethane; ASTM C920, Grade NS, Class 50, Uses M, G, A, and O; multi- component. Reference Division 32 sections for sealants related to paving and sidewalks.
1. Type: Dymeric 240FC manufactured by Tremco.
2. Color: Standard colors matching finished surfaces.
3. Applications: Use for:
   a. Control, expansion, and soft joints in masonry.
   b. Joints between concrete and other materials.
   c. Joints between metal frames and other materials.
   d. Exposed joints in metal copings, trim, and flashings.
   e. Other exterior nontraffic joints for which no other sealant is indicated.

B. Exterior Foam Expansion Joint Sealer: Pre-compressed foam sealer; Polyurethane with water-repellent, +/- 25 percent movement capability.
1. Color: Face color as selected.

2. Size: As required to provide watertight and airtight seal when installed.
3. Applications: Use for exterior wall expansion joints.
4. Manufacturers:
   a. Colorseal; Emseal Corp. www.emseal.com.
   b. Polytite R or Polytite Standard; Dayton Superior www.daytonsuperior.com.
   c. Illmod 600; Tremco www.tremco.com.
   d. Willseal 600; Willseal USA LLP www.willsealusa.com.
   e. Substitutions: Section 01 25 00 – Substitution Procedures.

C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
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.

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 31 13 – Project Coordination: 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 77 00 – Closeout Procedures: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: Protecting installed construction.

B. Protect sealants until cured.

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 interior and exterior doors, sidelights, and windows.
   2. Interior and exterior steel doors.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware: For finish hardware requirements of steel doors and frames.
   2. Section 08 80 00 – Glazing: For glazing panels set in steel frames and glass lights set in steel door faces.
   3. 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 31 13 – Project Coordination: 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. Door Pro Systems www.doorprosystems.com
2. Ceco Door www.cecodoor.com
3. Curries www.curries.com
4. Steelcraft www.allegion.com
5. Masonite www.masonite.com
6. Pearland Industries
7. 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. Metal stops: Metal stops at door lites to match hollow metal frame color.

C. End Closure: Channel, 0.04 inches thick, flush.

D. Core: Manufacturer’s standard core consisting of one of the following (no honeycomb):
1. Polyurethane.
2. Polystyrene foam.
3. Mineral fiberboard.

E. 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.

E. Sound seals: Provide sound seals at all interior mechanical rooms.

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, match hollow frame color.
3. Attach fire rated label to each fire rated door.
4. Door Thickness: 1-3/4”

B. Frames:
1. Fabricate frames as welded unit.
2. Hot Dip Galvanize frames at exterior.
3. Mullions for Double Doors: Removable, specified in Section 08 71 00. Removable mullions shall be key locked type.
4. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
5. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
6. 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.

7. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors.
8. Attach fire rated label to each fire rated frame.
9. Provide full depth stop at center of frames to receive removable mullions, such that top of mullion seats flush with frame.
10. Hollow metal window frames shall be detailed to accept a blind that is mounted inside the frame. Coordinate with Division 12 – Furnishings.
11. Glazing Stops: Provide non-removable stops on the outside and removable, screw-applied stops on the room side of doors and frames for glass.
12. Frame thickness:
    a. Interior Openings:
        1) Less than 4’-0” inches in Width: 16-gauge.
        2) Greater than 4’-0” inches in Width: 14-gauge.
    b. Exterior Openings:
        1) 14-gauge.

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. Inspection of Conditions: Contractor shall require the installer or each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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.

G. Brace new frame installed in existing wall to prevent movement.

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 77 00 – Closeout Procedures: 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 31 13 – Project Coordination: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.9 WARRANTY

A. Section 01 77 00 – Closeout Procedures: 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. Door Pro Systems www.doorprosystems.com
2. Oshkosh Architectural Door Company oshkoshdoor.com
3. Marshfield Door Systems Inc. www.marshfielddoors.com
4. VT Industries www.vtindustries.com
5. Substitutions: Section 01 25 00 – Substitution Procedures.

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. Edges: Hardwood, painted edges.

E. Plastic Laminate Facing (Interior): NEMA LD-3, General Purpose Type, 0.050-inch-thick, type as indicated on Drawings.

F. Cross Banding Behind Laminate Finish: 1 ply; manufacturer’s standard construction.

G. 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. Inspection of Conditions: Contractor shall require the installer or each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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.

D. Do not install doors and other finish materials until spaces are dried-in and conditioned.

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 77 00 – Closeout Procedures: 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 31 13 – Project Coordination: 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. The Bilco Company.
   3. Acudor Products, Inc.
   4. Nystrom Building Products, Inc.
   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. Inspection of Conditions: Contractor shall require the installer or each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 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 81 19 – Project Meetings: 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 77 00 – Closeout Procedures: Product warranties and product bonds.

B. Special Assembly Warranty: Written warranty signed by Manufacturer, Contractor, and Installer 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

A. ALUMINUM-FRAMED GLAZING SYSTEMS

A. Manufacturers:
1. Kawneer www.kawneer.com
2. EFCO Corporation www.efcocorp.com
3. Tubelite, Inc. www.tubeliteuse.com
4. Oldcastle Building Envelope www.obe.com
5. Vistawall International. www.vistawall.com/
6. YKK AP America Inc., www.ykkap.com.
7. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Basis-of Design:
1. Exterior Storefront Door and Window Frames: Kawneer *IR501T.*
2. Entrance Doors: Kawneer *Series 500 Tuffline Wide Stile*.
3. Interior Storefront Door and Window Frames: Kawneer *Trifab VG 451.*

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 1/2-inches wide x 5-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 10-inch wide top rail 5-inch wide vertical stiles, minimum 10-inch wide bottom rail; 3/16” wall thickness; beveled glazing stops for 9/16” laminated 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. Inspection of Conditions: Contractor shall require the installer or each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 77 00 – Closeout Procedures: Testing, adjusting and balancing.

B. Adjust operating hardware and sash for smooth operation

3.5 CLEANING

A. Section 01 77 00 – Closeout Procedures: 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 77 00 – Closeout Procedures: Protecting installed construction.

B. Protect finished Work from damage.

END OF SECTION

SECTION 08 56 53 – OPERABLE SECURITY WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Horizontal sliding windows.

B. Related Sections:
   1. Section 08 80 00 - Glazing: General glass requirements for factory-installed glazing provided under this section.
   2. Section 08 87 23 – Impact Resistant Glazing Film: Field applied glazing film for this factory installed glazing.

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. Location of weep holes.
   5. Panning details.
   6. Hardware, including operators.
   7. Glazing details.
   8. 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: Minimum 1 year after date of Substantial Completion. Warranted failures include but are not limited to:
   1. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Structural failures including deflections exceeding 1/4 inch.
   3. Failure of welds.
   4. Faulty operation of sliding window hardware or locking hardware.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Quickserv Corporation, www.quikserv.com.
   2. Ready Access, www.ready-access.com.
   3. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Basis-of-Design: *Model SC-4040 Single Slider* as manufactured by Quikserv or approved equivalent by specified manufacturer.
   1. Self-closing horizontal slider with magnetic hold-open.
   2. Top-hung ball bearing glide system.
   3. Offset bottom guide to prevent push-in from outside.
   4. Nominal 48” x 48” with 20”W x 41”H service opening, or custom size as indicated in the drawings.
   5. Heavy duty maximum security lock with hook bolt and inside thumb-turn.
   6. Automatically locks each time door closes to prevent outside penetration.
   7. Frame flush to outside wall.
   8. Right-hand or left-hand unit(s) as indicated.

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 0.125 inch (3.2 mm) thick at any location for main frame and sash members.

B. Fasteners: Provide mechanical fasteners that are 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 complying with requirements of ASTM B 633.

D. 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 system 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.

2.4 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.

B. Preglazed Fabrication: Preglaze window units at the factory:
   1. Provide Laminated Safety Glazing of the following Construction:
      a. 1/4” clear annealed glass + 0.09” PVB interlayer + 1/4” clear annealed glass for a total thickness of 9/16”.
      b. Materials shall be in accordance with Division 8 Section "Glazing" of these Specifications and AAMA 101.
   2. Provide units that are reglazable without dismantling sash or ventilator framing.

2.5 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. Dark bronze anodized finish or as indicated.

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. Drywall surfaces shall be taped and floated and ready for painting.

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 087100

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.
6. 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.
7. 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

130430 OPT0418831 Version 1
Hardware Group No. 103 - SGL OFFICE

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

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/EDA-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

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. 205 - SGL STORAGE EXTERIOR

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	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-SHCUSH-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

Hardware Group No. 341 - TYPICAL SGL PRIVATE TOILET - PRIVACY/INDICATOR

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/EDA-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/3551AA-Z49 (WD/MD AS REQ)	AA	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 343 - SGL PRIVATE TOILET

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	L9044 17A L583-363 L283-722	626	SCH
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/3551AA-Z49 (WD/MD AS REQ)	AA	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

Hardware Group No. 503 - SGL CLASSROOM LOCK

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	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
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 503S - SGL CLASSROOM LOCK OH STOP

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	CLASSROOM LOCK	L9070HD 17A	626	SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 710M - PAIR PANIC DEV

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	REMOVABLE 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-RW/PA/EDA-TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPROPRIATE	630	IVE
2	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 711 - SGL EXIT DEV VANDAL TRIM

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/EDA-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. 715X - SGL EXIT DEV EXTERIOR (HM)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	700-HEIGHT REQD	630	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	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	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

HARDWARE SET IS A GUIDELINE.
GENERAL CONTRACTOR/HW SUPPLIER FIELD-VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTAL/ORDERING. PROVIDE/REPLACE ALL PRODUCTS/COMPONENTS NECESSARY FOR COMPLETE, FUNCTIONING COMPLIANT OPENING. ADVISE ARCHITECT OF ANY INCOMPATIBILITY REGARDING DOOR/FRAME/HARDWARE. GC AND HARDWARE SUPPLIER TO REVIEW ALL OPENINGS/HARDWARE SETS WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.
IN SUBMITTAL PROVIDE NAME, COMPANY AND DATE OF FIELD VERIFICATION. REPLACE ANY EXISTING MECHANICAL/ELECTRICAL HARDWARE THAT DOES NOT OPERATE PROPERLY.
PROVIDE FILLER/COVER PLATES/BONDO/ETC WHERE REQUIRED.

Hardware Group No. C710MAC - PAIR EXIT DEV (ALUM VEST) ACCESS CONTROLLED

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	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	PA MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C711A - SGL EXIT DEV - ACCESS CONTROLLED

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	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 RW/PA/EDA TBSRT X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C714M - PAIR EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED

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	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C714MA - PAIR EXIT DEV EXTERIOR (ALUM) ACCESS CONTROLLED

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	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	PA MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
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	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

Hardware Group No. C715X - SGL EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED

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	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

HARDWARE SET IS A GUIDELINE.
GENERAL CONTRACTOR/HW SUPPLIER FIELD-VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTAL/ORDERING. PROVIDE/REPLACE ALL PRODUCTS/COMPONENTS NECESSARY FOR COMPLETE, FUNCTIONING COMPLIANT OPENING. ADVISE ARCHITECT OF ANY INCOMPATIBILITY REGARDING DOOR/FRAME/HARDWARE. GC AND HARDWARE SUPPLIER TO REVIEW ALL OPENINGS/HARDWARE SETS WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.
IN SUBMITTAL PROVIDE NAME, COMPANY AND DATE OF FIELD VERIFICATION. REPLACE ANY EXISTING MECHANICAL/ELECTRICAL HARDWARE THAT DOES NOT OPERATE PROPERLY.
PROVIDE FILLER/COVER PLATES/BONDO/ETC WHERE REQUIRED.

Hardware Group No. CR715X - SGL EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED

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	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
	EA	DESK MOUNT BUTTON	660-PB - BY SECURITY CONTRACTOR	628	SCE
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O

HARDWARE SET IS A GUIDELINE.
GENERAL CONTRACTOR/HW SUPPLIER FIELD-VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTAL/ORDERING. PROVIDE/REPLACE ALL PRODUCTS/COMPONENTS NECESSARY FOR COMPLETE, FUNCTIONING COMPLIANT OPENING. ADVISE ARCHITECT OF ANY INCOMPATIBILITY REGARDING DOOR/FRAME/HARDWARE. GC AND HARDWARE SUPPLIER TO REVIEW ALL OPENINGS/HARDWARE SETS WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.
IN SUBMITTAL PROVIDE NAME, COMPANY AND DATE OF FIELD VERIFICATION. REPLACE ANY EXISTING MECHANICAL/ELECTRICAL HARDWARE THAT DOES NOT OPERATE PROPERLY.
PROVIDE FILLER/COVER PLATES/BONDO/ETC WHERE REQUIRED.

Hardware Group No. J-1PL - SGL GATE PADLOCK

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PADLOCK (SFIC)	KS41D1200 / KS43D3200 X 1-1/2" SHACKLE		SCH
1	EA	SFIC EVEREST PERM CORE	80-037 CKC EV29 R	626	SCH
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		

PROVIDE MOUNTING ACCESSORIES AS REQUIRED.
GENERAL CONTRACTOR SHALL CONDUCT A COORDINATION MEETING WITH THE HARDWARE SUPPLIER AND GATE/FENCE FABRICATOR PRIOR TO HARDWARE BEING ORDERED - AND FENCE/GATE BEING FABRICATED.

Hardware Group No. R201A - SGL LOCK - REMOTE RELEASE

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	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 RW/PA/EDA TBSRT X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	DOOR STOP (TYPE REQD)	WS406/WS407CCV/FS436/OH STOP - AS REQD	626	IVE
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
1	EA	VARIABLE LENGTH WIRE HARNESS	CON-XXP LENGTH AS REQ		SCH
1	EA	WIRING HARNESS (6")	CON-6W (FOR CONNECTION TO FIELD WIRING)		SCH
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC (OMIT 4RL BOARD WHERE NOT REQ)		VON

END OF SECTION

OPT0418831 Version 1

Door#	HwSet#
HG100A	C714MA
HG100B	C714M
HG101	103
HG102	205
HG103	203
HG104	341
HG105	341
HG107	J-1PL
P100A	C714MA
P100B	C714M
P101	205
P102	103
P103	203
P104	341
P105	341
P107	J-1PL
R100A	710M
R100B	C714M
R100C	711
R100E	710M
R101	103
R102	203
R103	201
R104	205
R105	503
R106	103
R106	503
R107	103
R108	203
R109	341
R110	503S
R111	203
R112	503
R113A	R201A
R113B	C710MAC
R114C	C711A
R115	343
XR100C	715X
XR113C	CR715X
XR113D	715X
XR114A	C715X
XR114B	715X

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes glass and glazing for the following:
   1. Insulated, laminated glazing units for exterior aluminum storefronts.
   2. Glazing units for door lights.
   3. Fire rated glazing units.
   4. Insulated, laminated, fire-rated exterior glazing units.
   5. Other miscellaneous glass products.

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 Systems.

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.

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.

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 81 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 31 13 – Project Coordination: 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 77 00 – Closeout Procedures: 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.

1.11 PRODUCTS 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. Viracon www.viracon.com
5. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Fire-Rated Glazing
1. SaftiFirst; safti.com
2. FireLite; www.fireproofglass.com/firelite
3. Substitutions: Section 01 25 00 – Substitution Procedures.

PART 2 - EXECUTION

2.1 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

2.2 SCHEDULED GLAZING TYPES – As indicated in the drawings.

A. Type GL-1: Dual-pane clear glazing units for all exterior 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 Guardian or approved equivalent by a specified manufacturer.
   2. Total Unit Thickness: 1-5/16”, 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-2: Single-pane laminated glass at interior storefront systems, fixed windows, and door lights at security vestibules.
   1. Basis of Design: Insulated system manufactured by Guardian 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.

C. TYPE GL-3: 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.

D. TYPE GL-4: Fire Rated.
   1. Composed of multiple sheets of clear tempered glass laminated with intumescent interlayers meeting requirements of ASTM E119 and safety standards of ANSI Z97.1 and/or CPSC 16CFR1201 (Cat. I and II).
   2. Basis of Design: *SuperLite II-XL* as manufactured by SaftiFirst or approved equivalent by Firelite.
   3. Thickness minimum 5/8” thick or greater as required to meet indicated rating.
   4. Labeling: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory (UL), fire rating period,

safety glazing standards, and date of manufacture.

E. Type GL-5: 45-Minute Fire rated, dual-pane clear glazing units. with aluminum and silicone edge seal; black edge seal color; purge interpane core space with dry hermetic air.
   1. Basis of Design: *SuperLite II-XL*-45 as manufactured by SaftiFirst or approved equivalent by Firelite.
   2. Total Unit Thickness: 1-3/4”, including nominal 1/2" dry air core and low-E coating applied to No. 2 surface.
   3. Impact-Resistant Glazing Film applied to No. 3 surface, refer to Section 08 87 23.

2.3 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. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 77 00 – Closeout Procedures: 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 77 00 – Closeout Procedures: 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 87 23 – IMPACT-RESISTANT GLAZING FILM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes installation of impact-resistant glazing film for certain exterior and interior glazing panels as indicated in the drawings.

B. Related Sections:
1. Section 08 80 00 - Glazing.
2. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

1.2 REFERENCES

A. American Society of Civil Engineers
1. ASCE-7 “Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."

B. ASTM International:
1. ASTM F-1642-04 “Standard Test Method for Glazing and Glazing systems Subjected to Airblast Loadings.”

C. General Services Administration
1. GSA “Standard Testing Method for Windows and and Glazing systems Subject to Dynamic Overpressure Loadings”.

D. Underwriters Laboratory
1. UL 972 for Delayed Forced Entry.

1.3 PERFORMANCE REQUIREMENTS

A. Provide impact-resistant glazing film where indicated for single-pane and dual-pane insulated glass units as required to meet or exceed the following criteria:

B. Impact Resistance: Armor Glass safety films shall be capable of meeting the following tests:
1. 7 mil and thicker safety film:
a. Passes ANSI Z 97.1 (100 - 150 ft lb).
b. Passes CFR 1201, Category II.
2. Installed system shall meet TEA requirements and UL 972 for Delayed Forced Entry.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Glazing Films: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
2. Perimeter Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

C. Samples:
1. Glass Panels: Submit two samples 12x12 inch in size, for each type of glazing film required, and each type of glass to receive glazing film, including any spandrel glass, wire glass, or other specialty glass.

2. Perimeter Sealant: Submit 12-inch long bead of proposed perimeter sealant.
3. Sealant Cover: Submit 12-inch long strip of proposed vinyl cover and preformed corner.

D. Film Manufacturer's Certificate: Certify specified glass products including sealed insulating units, spandrel glass, tinted glass, low-E coated glass, and any fire-rated glass are appropriate products to receive glazing film and will not negatively affect glazing panel performance.

1.5 QUALIFICATIONS

A. Manufacturer Qualifications: Solar film manufacturer shall be the standard product of a manufacturer regularly engaged in the manufacture and distribution of such products in satisfactory use for a minimum of 5 years. Manufacturing facility shall be ISO 9001-2000 and ISO 14001-2004 standard registration.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Apply film to one or more windows designated by Architect.
2. Do not proceed with remaining work until application is approved by Architect for workmanship and color.

1.6 PRE-INSTALLATION MEETING

A. Section 01 81 19 – Project Meetings: Pre-installation meeting.

B. Convene minimum one week before starting Work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install glazing films or liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish written 12-year labor and material warranty to include coverage for glazing films from delamination, bubbling or rippling, cracking, color change, optical transparency change, failure to provide impact protection within limitations as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM MANUFACTURERS

A. Solar Gard (Saint-Gobain) www.solargard.com
B. 3M. www.3m.com
C. Llumar. llumar.com/na/en
D. Madico. madico.com
E. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Glazing Film: High strength Mylar polyester, optically clear and without waviness or other distortion. Colorless or tinted as selected.
   1. Basis of Design: *Saint Gobain Solar Gard* clear film as distributed by Armor Glass International, Inc. or approved equivalent by specified manufacturer.
   2. Film thickness:
      a. Minimum 8-mil unless indicated otherwise in the drawings.
   3. Film Performance:
      a. Solar Transmittance 69%.
      b. Solar Absorption 21%.
      c. Solar Reflectance 10%.
      d. Visible Light Transmittance 83%.
      e. Visible Light Reflectance (Exterior) 13%.
      f. Visible Light Reflectance (Interior) 12%.
      g. Emissivity: 0 .88.
      h. U-Factor (Winter) 1.11.
      i. Shading Coefficient .87.
      j. Solar Heat Gain Coefficient 0.74.
      k. Ultraviolet Light Blocked (300-380 nanometers) greater than 99%.
      l. Total Solar Energy Rejected 24%.
   4. Physical and Thermal Properties:
      a. Film Thickness: 8.0 mils (200 microns).
      b. Peel Strength: 2,500 g/in (984 g/cm).
      c. Tensile Strength; 30,000 lbs/sq in (2,110 kg/cm sq).
      d. Break Strength; 240 lbs/in (43 kg/cm).
      e. Elongation at Break: greater than100%.
      f. Combustion Rate: Negligible.
      g. Melting Point: 260-265 degrees C.
      h. ASTM D 4830 Puncture Test: 141 lbs (64 (kg).
      i. Meets GSA Level C criteria (3B at 4psi, 28 psi/milliseconds).

B. Bonding Agent: Film manufacturer’s recommended optically clear and colorless water-based water-thin aqueous mixture used for filling microscopic pores and valleys of the glass while providing enhanced bonding of film and adding measurable strength to the glass panel.

C. Perimeter Sealant: *Dow 995 Structural Silicone Sealant*, black color.

D. Sealant Protective Cover: Black vinyl bonding cap with preformed corners; *BondKap* system or approved equivalent.

E. Applied system shall be odor-free and non-toxic after 72-hour cure time.
   1. Flame Spread: 0.
   2. Smoke Developed: 0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces of glazing panels are clean, free of haze or visual distortion, dry, and ready to receive glazing.

3.2 PREPARATION

A. Remove any glazing labels or protective tape or other markings on film application side of glazing panel. Replace any removed safety labels or tape on non-application side of glass.

B. Clean contact surfaces with mild water-based solution, rinse thoroughly with clear potable water, and wipe dry.

C. Ensure surfaces of glazing panels are clean, free of haze or visual distortion, dry, and ready to receive glazing film.

3.3 INSTALLATION

A. Uniformly spray apply bonding agent to interior face of exterior glazing and to secure side of interior glazing.

B. Apply film and use rubber-edged glazing squeegee to remove all excess liquid, air bubbles, wrinkles, and other distortions.

C. Trim film edges at intersection of glazing gasket/stop and glass panel, and squeegee edges along glazing gasket.

D. Clean overspray of bonding agent and allow system to cure a minimum of 72 hours.

E. Perimeter Sealant:
1. Once glazing film system is fully cured, glazing shall be perimeter bonded to the framing on the film side with a continuous bead of the black color structural sealant extended onto both framing and glass a minimum of 1/2-inch.
2. Bonding sealant shall be neatly trimmed and covered with specified black vinyl bonding cap.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Provide final cleaning and polishing of applied film.

C. Do not remove any safety labels or tape from non-application side until removal is approved by General Contractor.

D. Clean 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.

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 31 13 – Project Coordination: 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 77 00 – Closeout Procedures: 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. Airolite Co. www.airolite.com
2. Construction Specialties, Inc. www.c-sgroup.com
3. Greenheck Fan Corporation. www.greenheck.com
4. Ruskin Mfg. www.ruskin.com
5. Substitutions: Section 01 25 00 – Substitution Procedures.

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.

B. Color: Selected by Architect. Full range of RAL colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection of Condition: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 77 00 – Closeout Procedures - 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. Impact-Resistant gypsum board.
5. Cement-fiber tiling backer board and related membrane.
6. Acoustic insulation and sealant.
7. Glass mat gypsum sheathing board.
8. 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.

C. Control joint locations: Submit drawings showing control joint locations. Refer to 3.3 INSTALLATION.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840.

B. Provide a minimum Level 4 Finish at all painted drywall locations. Refer to paragraph *3.6 SCHEDULES*.

C. 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.

D. 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 81 19 – Project Meetings: 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 25 00 – Substitution Procedures.

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. Impact-Resistant Gypsum Board:
1. Basis of Design: M-Bloc® Impact-Resistant Type X as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. 5/8” impact, abuse, fire, mold and moisture-resistant gypsum core encased in heavy abrasion, mold and moisture resistant 100% recycled paper.
3. Abrasion-Resistance: Level 3 per ASTM C1629.
4. Indentation-Resistance: Level 2 per ASTM C1629.
5. Soft or Hard Body Impact-Resistance: Level 3 per ASTM 1629.
6. Water Absorption: Less than 5% per ASTM 1396.
7. Meet requirements of Federal Specification SS-L-30D Type lll, Grade X.
8. Use at locations as indicated in the drawings.

F. 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 31 13 – Project Coordination: 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. Provide control joints at all openings (door, window, cased) in drywall partitions to allow for differential movement without significant damage to finishes. Ensure fire rating is maintained behind control joints in fire rated partitions.
6. Maximum control joint spacing for walls and ceilings without perimeter relief is 30 feet. With perimeter relief the maximum recommended control joint spacing relief is 50 feet.
7. Finish cementitious backer board in accordance with manufacturer’s instructions.

H. Inaccessible or limited access areas.
1. Provide (2) 4-inch conduit within drywall furring or above ceiling at high volume corridors or other areas where access is limited, for future technology, security, other electrical. Coordinate locations with Architect during construction.

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 24 00 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Portland cement plaster and metal lath for:
   1. Exterior soffits.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C91 - Standard Specification for Masonry Cement.
   2. ASTM C150 - Standard Specification for Portland Cement.
   3. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
   4. ASTM C847 - Standard Specification for Metal Lath.
   5. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
   6. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.
   7. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
   8. ASTM D226 - Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.

B. Portland Cement Association:
   1. PCA - Portland Cement Plaster (Stucco) Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on plaster and lath materials, characteristics and limitations of products specified.

C. Samples: Submit two samples, 12 x 12 inch in size illustrating finish color and texture.

1.4 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.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold-Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.
   1. Exterior Plaster Work: Do not apply cement plaster when ambient temperature is less than 40 degrees F.

C. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

1.6 WARRANTY

A. Section 01 77 00 – Closeout Procedures: Requirements for warranties.

B. Furnish seven-year warranty for elastomeric finish coat materials applied over specified substrate.

PART 2 - PRODUCTS

2.1 COMPONENTS:

A. Plaster Base Coat Materials:
1. Cement: ASTM C150, Type I Portland cement.
2. Lime: ASTM C206, Type S.
3. Aggregate: In accordance with ASTM C897.
4. Masonry Cement: ASTM C91, Type N.

B. Elastomeric Finish Coat: Integrally-colored, 100 percent acrylic elastomeric polymer with marble aggregates, water-based, VOC compliant; for use over plaster base coat. Include manufacturer's recommended primers and sealing topcoats for finishes.
1. Manufacturers:
a. Dryvit Systems, Inc., www.dryvit.com.
b. Parex, www.parex.com.
c. Senergy, www.senergy.com.
d. Sto Corp, www.stocorp.com.
2. Basis-of-Design: Parex e-lastic 426 Flexfine.
3. Color: To be selected by Architect from manufacturer’s full range.

C. Furring And Lathing:
1. Expanded Metal Lath: ASTM C847, galvanized, zinc-coated, diamond mesh, self-furring, of the following weights:
a. 3.4 lb/sy for horizontal applications.
b. 2.5 lb/sy for vertical applications.
2. Casing Bead: Formed zinc, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges, notched to same profile as control joint.
3. Corner Bead: Formed zinc, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges with small radius edge.
4. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, expanded flanges shaped to permit complete embedding in plaster, minimum 2 inch size; galvanized.
5. Strip Mesh: Expanded metal lath, minimum 0.018 inch thick, 2 inch wide x 24 inch long; galvanized.
6. Control Joint: Formed zinc, depth governed by plaster thickness, maximum possible lengths, accordion profile, 2 inch expanded metal flanges each side.
7. Soffit Vent: Extruded aluminum W-molding with 3/4 inch wide vented reveal, depth governed by plaster thickness, maximum possible lengths, clear anodized finish.
8. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
9. Fasteners: ASTM C1002, self-drilling, self-tapping screws.
10. Building Paper: ASTM D226, Type I, No. 15 un-perforated asphalt felt.
11. Access Panels: Specified in Section 08 31 13.

2.2 MIXES

A. Plaster Base Coats: Mix and proportion cement plaster base coat in accordance with ASTM C926, Type C or CM.

B. Mix only as much plaster as can be used prior to initial set.

C. Mix materials dry, to uniform color and consistency, before adding water.

D. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

E. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 – Project Coordination: Coordination and project conditions.

B. Concrete: Verify surfaces are flat, honeycomb are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.

C. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.2 INSTALLATION

A. Installation of Soffit Framing Materials:
1. Install soffit framing in accordance with Section 09 21 16 - Gypsum Board Assemblies.
2. For exterior soffits, provide cross-bracing and additional framing required to resist wind uplift for design loads of 20 psf inward and outward.

B. Installation of Lathing Materials:
1. Apply one layer of building paper over bituminous dampproofing before installing metal lath; lap edges 2 inches minimum. Fasten in place.
2. Install metal lath in accordance with ASTM C1063.

C. Installation of Accessories:
1. Install accessories in accordance with ASTM C1063.
2. Place corner bead at external corners; fasten at outer edges of lath only.
3. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
4. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
5. Install soffit vents at the perimeter of all exterior soffits.
6. Coordinate work with installation of metal access panels. Refer to Section 08 31 13. Position to provide convenient access to concealed work requiring access.

D. Control Joints:
1. Install control joints where indicated on Drawings and the following:
a. Every 20 feet.
b. Panel proportions not to exceed length to depth ratio of 2-1/2 to 1.
c. Horizontal panel size not to exceed 100 sf.
d. Vertical exterior panel size not to exceed 144 sf.
2. Establish control joints with specified joint device.
3. Coordinate joint placement with other related work.

E. Plastering Exterior Walls:
1. Apply two coats plaster over metal lath in accordance with ASTM C926, and elastomeric finish coat.
2. Apply scratch coat to nominal thickness of 0.375 inch, and brown coat to nominal thickness of 0.375 inch.
3. Moist cure scratch and brown coats. Apply brown coat immediately following initial set of scratch coat.
4. Apply elastomeric finish coat to plaster brown coat in accordance with manufacturer's instructions. Prime brown coat prior to applying coating as required by manufacturer.

F. Plastering Soffits:
1. Apply two coats plaster over metal lath in accordance with ASTM C926, and elastomeric finish coat.
2. Apply scratch coat to nominal thickness of 0.25 inch, and brown coat to nominal thickness of 0.25 inch.
3. Moist cure scratch and brown coats. Apply brown coat immediately following initial

set of scratch coat.

4. Apply elastomeric finish coat to plaster brown coat in accordance with manufacturer's instructions. Prime brown coat prior to applying coating as required by manufacturer.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat Surface: 1/8 inch in 10 feet

3.4 ADJUSTING

A. Section 01 77 00 – Closeout Procedures: Testing, adjusting, and balancing.

B. Remove damaged or defective plaster by cutting and replace with specified materials to match adjacent plaster.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Floor and wall tile as indicated on drawings.
2. Marble thresholds at restroom and shower 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 90 00 - Joint Protection.
3. Section 09 21 16 - Gypsum Board Assemblies: Moisture resistant gypsum board and cementitious backer board for wall tile application.

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 77 00 – 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 81 19 – Project Meetings: 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 77 00 – Closeout Procedures: 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 Olean; Div. of Dal-Tile International Corp.
2. Crossville Ceramics Company, L.P.
3. Daltile; Div. of Dal-Tile International Inc.
4. Additional manufacturers as may be listed in the Finish/Color Schedule.
5. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 COMPONENTS – Tile Types correspond to Types indicated on the Finish/Color Schedule:

A. Ceramic Wall Tile: ANSI A137.1, conforming to the following:
1. Basis of Design: Small format, as scheduled.
2. Moisture Absorption: 0 to 0.5 percent.
3. Surface Finish: Glazed as scheduled.
4. Joint Size: 1/8”.
5. Use sanded latex-Portland cement grout, except at showers (epoxy emulsion).
6. Base: As scheduled.

B. Porcelain Floor Tile - ANSI A108/118, conforming to the following:
1. Manufacturer: manufacturer, style and color as scheduled.
2. Sizes: Mosaic, as scheduled.
3. Shape: Square, field cut as required.
4. Edge: Square.
5. Joint Size: 1/8”.
6. Surface Finish: Unglazed.
7. Type: Through-color.
8. Use epoxy emulsion grout at showers.

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 25 00 – Substitution Procedures.

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: 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.

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 25 00 – Substitution Procedures.

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. Epoxy Grout: 100% solids, chemical-resistant, industrial-grade modified epoxy grout; 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. 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.

D. Cementitious Backer Board: As specified in Section 09 21 16.

E. 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 restroom entry door
    b. Opening without door: Center on wall opening or frame.

F. Trowelable Underlayments and Patching Compounds: Latex-modified cementitious type, Planiprep SC as manufactured by MAPEI Corporation or approved equivalent by ARDEX Engineered Cements.

G. 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.

H. 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 31 13 – Project Coordination: 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. At showers, ensure that PVC liner sheet is properly Installed over concrete sub-slab, under floor drain clamping ring, and turned up minimum 6” on surrounding walls/curbs prior to installing sloped mortar bed for tile. Liner sheet must be installed in strict accordance with membrane manufacturer’s printed recommendations.

F. Install liquid-applied membrane at sloped shower floor and wall substrates prior to tile installation. Prepare surfaces and install in strict accordance with waterproofing membrane manufacturer’s printed recommendations.

G. Seal substrate surface cracks with filler.

H. 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 Methods:
1. Over interior concrete slabs and recessed mortar bed at shower floors, 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.
2. At shower floors and upper-floor restrooms, ensure that specified liquid-applied membrane is installed, turned up substrate wall, and properly cured before beginning tiling operations.

N. Installation - Wall Tile: Thin-Set:
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 acid-resistant latex-Portland cement grout at restrooms. At showers use epoxy emulsion grout.

O. 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.

P. 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.

Q. 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 77 00 – Closeout Procedures: Final cleaning.

B. Clean tile and grout surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: 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 81 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. 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-3: ASTM E1264, Type IV conforming to the following:
1. Basis of Design: *Clean Room VL #868* as manufactured by Armstrong or approved equivalent by specified manufacturer.
a. Kitchen or food preparation 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. Provide white aluminum cap at restrooms, food service, shower rooms, and other wet or high humidity areas.

C. APC- 5: ASTM E1264, Type III conforming to the following:
1. Basis of Design: *Armatuff #861* as manufactured by Armstrong or approved equivalent by specified manufacturer.
a. Gymnasium, as indicated on drawings.
2. Size: 24 x 24 inches.
3. Thickness: 3/4 inches.
4. Composition: Mineral fiber, high density wet-formed.
5. Light Reflectance Coefficient: 0.87.
6. CAC: 33.
7. Edge: Square Lay-In, 15/16 inches.
8. Surface Color: White.
9. Surface Finish: Factory-applied latex paint
10. Special Treatment: Bioblock.
11. NRC: 0.50.
12. Fire Performance: Class A (UL).
13. Sag/Humidity Resistance: HUMIGUARD Plus.

14. Grid: 15/16” wide, factory powder coat white, Prelude XL. Provide white aluminum cap at restrooms, food service, shower rooms, and other wet or high humidity areas.

D. Grid:
1. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking.
2. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
   a. Basis of design, Prelude XL as manufactured by Armstrong or approved equivalent by specified manufacturer.
3. 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.
4. 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 64 99 - WOOD STEPS REFINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes repair and refinishing of existing Oak treads, risers, and 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: Submit two samples wood flooring, 12” x 12” illustrating full range of color variations expected.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, suggested schedule for cleaning, repair of finish, and recommended maintenance products including polishes and waxes.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NOFMA 24 - National Oak Flooring Manufacturers Association.

1.5 QUALIFICATIONS

A. Company specializing in performing the work of this section with minimum three years’ experience in similar projects.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 81 19 – Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Review installation procedures including procedures for temporary protection of re-finished materials.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not begin re-finishing of wood steps until other construction work in the affected area 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 for minimum period of two days prior to beginning work, and for a minimum period of seven days after completion of finishing operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wood Material for Repairs: Red or White Oak as required to match existing.
   1. Grade: Match existing.
   2. Cut: Plain sawn.

3. Moisture Content: 12 to 14 percent.
4. Thickness: Match existing.

B. Sleepers and Shims: Softwood lumber, 2 x 4 inch size.

C. Subflooring: APA wood veneer plywood, 3/4 inch thick, with square edges.

D. 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.

E. Finish: "Duraseal" combination stain/sealer and clear solvent-based satin polyurethane sealer/finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 – Project Coordination: Coordination and project conditions.

B. Visit the site prior to bidding in order to verify the condition of existing wood steps and determine extent of any damaged wood to be repaired prior to refinishing.

C. Verify any replacement wood material has been acclimated to ambient temperature and humidity conditions for a minimum of two days.

3.2 PREPARATION

A. Damaged Areas:
1. Use oscillating power saw to neatly cut out any damaged finish wood up to sound end joints.
2. Replace any damaged existing subflooring with plywood. Replace any damaged existing screeds or framing with new lumber.
3. Install pigmented wood filler in any open joints remaining in existing finished wood. Allow wood filler to cure, then sand smooth and flush with finish wood.

3.3 SANDING

A. Rough sand new wood where required to level top of new wood with existing.

B. After rough sanding of new wood, proceed with second sanding with No. 100 grit paper using random orbital power sander. Use no rotary sanders throughout the finish sanding process.

C. Third sanding shall be with 120 and 220 grit papers. Provide additional sanding if required by the Architect to achieve smooth finish free of sanding marks.

3.4 FINISHING

A. Sweep and vacuum floor to remove all traces of sanding dust. Use tack rags immediately prior to applying finish. Just prior to applying any coat of finish, use tack rag to remove any fine dust.

B. Seal wood with one liberal coat of specified sealer/stain in selected tone according to manufacturer's printed directions, with approximate coverage of 350-square feet per gallon.

C. Allow finish to dry thoroughly 24 to 36 hours, then burnish with steel wool and clean thoroughly with vacuum and tack rag. Apply second coat as clear finish over stained coat.

D. Allow second coat to dry 24 to 36 hours, then burnish with steel wool and clean thoroughly with vacuum and tack rag. Apply final coat of clear finish.

E. Where only clear finish is selected and no stain, three (3) coats of finish are still required. Do not wax.

3.5 PROTECTION

A. Cordon-off area and protect finished flooring from traffic for a minimum of 72 hours after final coat.

B. Cover flooring with sheets of hardboard or sound-deadening paper to protect from traffic until final acceptance.

3.6 FINAL CLEANING

A. Section 01 77 00 – Closeout Procedures: Final cleaning.

B. Clean and polish finish wood surfaces with waterborne “Bona” floor cleaner.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Vinyl composition tile flooring.
   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.

B. Section 09 65 66 – Resilient Athletic Flooring: Rubber base provided under this Section 09 65 00.

1.3 REFERENCES

A. ASTM International:
   1. ASTM F1066 – Standard Specification for Vinyl Composition Floor Tile.
   2. ASTM F1861 - Standard Specification for Resilient Wall Base.
   3. 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 COMPOSITION TILE FLOORING

A. Manufacturers:
1. Tarkett with Techtonic Finish www.tarkettna.com
2. Mohawk Flooring with M-Force Finish, www.mohawkflooring.com
3. Patcraft with ExoGuard Finish, www.patcraft.com
4. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Vinyl Composition Tile
a. Basis of Design: *Match existing.*
b. ASTM F1700, Class 3, Type B.
c. Size: 12 x 12 inch.
d. Overall Thickness: 1/8-inch.
e. Type: Through-Pattern.
f. Minimum of 20 mil thick enhanced urethane wear layer with adhesive to function at a minimum of 98% RH concrete moisture level resistance – ASTM F2170-1.
g. Warranty: 20-years with no finish requirements to maintain the warranty.
h. Colors and patterns as indicated in the Color/Finish Schedule

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 25 00 – Substitution Procedures.

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. Two (2) percent or two (2) unopened cartons of each color and pattern of flooring selected, whichever is greater.
2. Two (2) percent or two (2) unopened cartons 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 77 00 -Closeout Procedures: 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 77 00 – Closeout Procedures: 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 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Rubber athletic sheet flooring, adhesively-applied.

1.2 RELATED SECTIONS

A. Section 09 65 00 - Resilient Flooring: Rubber base for areas receiving Resilient Athletic Flooring.

1.3 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 12’ x 12” samples of each color/pattern specified.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

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 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Unroll sheet material and allow to relax in environmentally-controlled room for 24 hours prior to installation.

C. Section 01 60 00 - Product Requirements.

D. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

E. 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.

1.7 EXTRA MATERIALS

A. Section 01 77 00 – Closeout Procedures: Spare parts and maintenance products.

B. Furnish additional 5% of packaged material for Owner’s future use for each type, color, and pattern of flooring installed.

PART 2 - PRODUCTS

2.1 RUBBER FLOORING

A. Manufacturers:
1. Tarkett Sports, www.tarkettsportsindoor.com
2. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Rubber Athletic Sheet Flooring: 100-percent recycled high-density rubber flooring.
1. Basis of Design*: Tarkett Ominisports*.
2. Color/texture as scheduled
3. Construction: Embossed, homogeneous product of vulcanized natural and synthetic rubbers with mineral aggregates, stabilizing agents, and pigmentation.
a. Surface: Printed faux wood design coated with clear PVC and UV cured urethane treatment.
b. Foam force reduction layer: High density closed cell PVC foam with honeycomb embossing.
c. Intermediate Layers: Reinforced with a non-woven fiberglass grid for dimensional stability.
d. Total Thickness: Layers vulcanized to form 0.27” (7.1 mm) overall thick sheet.
e. Antimicrobial treatment.
4. Recyclability:
a. Made from 30% recycled content and 100% manufacturing waste recycled.
b. FloorScore certified.
5. Wear Layer: Type 1 – Grade 1 per ASTM F1303/F410.
6. Impact Resistance: Passes EN 1717.
7. Ball Rebound: >90% per ASTM F2772.
8. Fire Rating: Class I per ASTM E648.
9. Roll Width: 6’-6”.

2.2 ACCESSORIES

A. Primers and Adhesives: Waterproof; types approved by flooring manufacturer.

B. Seam Welding Rods: Matching color and compatible material provided by flooring manufacturer.

C. Game-Line and Marker Paint: Enamel or other approved product, compatible with flooring and recommended by flooring and paint manufacturers for use indicated.

1. Colors: As indicated, or if not indicated, as selected by Architect from manufacturer’s full range of line colors

D. Transition Strips: Beveled strips that transition smoothly from the surface of rubber athletic flooring to the adjacent flooring.

E. Rubber Base: Coved, 4-inch high as specified in Section 09 65 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Verify concrete floors are dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting. 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. Perform calcium chloride testing on

existing concrete subfloors and submit written test results to Architect prior to beginning installation of bonded flooring.

C. Verify floor surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

D. Starting installation of flooring indicates installer’s acceptance of flooring substrate conditions.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

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.

C. Prohibit traffic until filler is cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION – RUBBER FLOORING

A. Lay flooring with joints and seams parallel to building lines. Provide wall-to-wall lengths where possible to avoid end seams. Butt all seams tightly and stagger end seams.

B. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

D. Install manufacturer’s pre-formed transition strips at exposed edges where flooring does not abut vertical surfaces.

E. Mask flooring at game lines and markers and apply paint to produce sharp edges.

F. At movable partitions, install flooring under partitions without interrupting floor pattern.

G. Section 01 77 00 – Closeout Procedures: Final cleaning.

H. Remove excess adhesive from floor, base, and wall surfaces without damage.

I. Clean, seal, and maintain resilient flooring products.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: Protecting installed construction.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

C. Do not move heavy or sharp 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.

D. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Vinyl wall covering.

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies: Wall substrate.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
   2. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls.

C. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on covering and adhesive.

A. Shop Drawings: Indicate wall elevations with seaming layout.

C. Samples: Submit two samples of each covering, 12x12 inch in size illustrating color, finish, and texture.

D. Manufacturer's Installation Instructions: Submit special installation 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 data on cleaning, touch-up, and repair of covered surfaces.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics:
   1. Textile Wall Coverings: Comply with one of the following:
      a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
      b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

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 approved by

manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Inspect roll materials on site to verify acceptance.

C. Protect packaged adhesive from temperature cycling and cold temperatures.

D. Do not store roll goods on end.

1.8 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 adhesive or vinyl covering product manufacturer.

C. Maintain these conditions 24 hours before, during, and after installation of adhesive and covering.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 - PRODUCTS

2.1 WALL COVERING

A. Wall Covering: FS CCC-W-408A and CFFA-W-101-A, Type II, Medium Duty; vinyl coated fabric roll stock, conforming to the following:
1. Total Weight: 20 – 21 oz/sq yd.
2. Roll Width: 54 inches.
3. Backing: Woven Fabric.

B. Basis of Design: As scheduled on drawings – *Valley Station Series* as manufactured by Koroseal.

C. Adhesive: Use only type recommended by covering manufacturer. (mildew resistant)

D. Tensile Strength: Must meet or exceed requirements of ASTM F793 for Type 2 wallcovering.

E. Tear Strength: Must meet or exceed requirements of ASTM F793 for Type 2 wallcovering.

F. Stain Resistance: Must exhibit excellent resistance to common staining agents as tested in accordance with ASTM F793.

G. Abrasion Resistance: No significant wear or change in appearance after 300 cycles per ASTM D4977.

H. Release Coat: Provide sealer or undercoat for new gypsum wallboard substrates as recommended by wallcovering manufacturer.

I. Substrate Filler: As recommended by adhesive and covering manufacturers; compatible with substrate.

J. Substrate Primer and Sealer: Type recommended by covering manufacturer.

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 and conform to requirements of covering manufacturer.

C. Measure moisture content of surfaces using electronic moisture meter. Do not apply coverings unless moisture content of surfaces is below the following maximums:
   1. Plaster and Gypsum Wallboard: 5-percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12-percent.
   3. Wood Surfaces: 15-percent, measured in accordance with ASTM D4442.

D. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at rate greater than 1/16 inch/ft.

E. Beginning wall covering installation indicates acceptance of substrates and conditions.

3.2 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Apply primer sealer to substrate surfaces as required, in accordance with manufacturer’s instructions. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Use covering in roll number sequence. Change run numbers at partition breaks and corners only.

B. Razor trim edges on flat work table, changing blade often to prevent rough cut edges. Do not razor cut on gypsum board surfaces.

C. Apply covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.

D. Horizontal seams are not acceptable.

E. Adhesive shall be mildew resistant.

F. Do not seam within 2-inches of internal corners or within 6-inches of external corners.

G. Remove excess adhesive while wet from seam before proceeding to next covering sheet. Wipe clean with dry cloth.

H. Trim wall covering 3/4” below top of resilient base.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean coverings of excess adhesive, dust, dirt, and other contaminants.

C. Reinstall wall plates and accessories removed prior to work of this section.

END OF SECTION

SECTION 09 84 00 - CEMENTITIOUS WOOD FIBER CEILING PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cementitious wood fiber acoustical deck-mounted panels.

B. Related Sections:
   1. Section 05 31 23 – Steel Roof Decking: Gauge and flute spacing for metal decking at Gym.

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 and color selected, 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 CEMENTITIOUS WOOD FIBER ACOUSTICAL PANELS

A. Manufacturers:
1. Armstrong www.armstrongceilings.com.
2. Acoustical Surfaces www.acousticalsurfaces.com
3. Baux Acoustical Panels www.baux.com/panels
4. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 MATERIALS

A. Basis of Design: Basis of Design: *Tectum Finale direct-mount panels* as manufactured by Armstrong.
1. 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:
2. Density: 30 to 45 lbs. per cu. ft. with maximum 10% moisture content; ASTM C 209.
3. 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.
4. Cementitious wood fiber Absorption: NRC of 0.85 for 1-inch thickness; NRC of 0.70 for 2-inch thickness; ASTM C 423.

B. Fabrication
1. General: Factory-fabricate the panels to sizes and configurations indicated and as follows:
a. 2-inch thick panel construction including 1” thick cementitious panels. 1” thick factory-attached wood perimeter furring, and 1” thick mineral wool acoustical infill. in face sizes as indicated on the drawings.
b. Edges: All edges factory-beveled.
2. Finish: Manufacturer's factory-applied painted finish on face, edges, and exposed perimeter furring.
a. Provide custom paint color(s) as selected by the Architect.
b. Provide number of coats necessary to provide complete hiding of raw wood fibers on all exposed surfaces.
c. Fastener Finishing: Paint heads of screws to match panels after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cementitious wood fiber panels in locations indicated with edges square to building lines and in alignment with adjacent panels.

B. Comply with panel manufacturer's printed instructions for installation of panels.

C. 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 for the particular substrate and panel weight, but no less than a 12" grid across the panel face

and 8” centers along the perimeter furring. Set screw heads flush with panel face.

D. All screw heads to be field painted to match selected panel factory paint color.

E. 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.
   4. Section 09 64 13 – Wood Steps Refinishing: Repair, sanding, and refinishing of existing wood steps.
   5. Section 09 96 53 – Elastomeric Coatings: Coating at exposed inside face of CMU at mechanical courtyard walls, or where specifically indicated.

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.
   1. Exposed High Roof Decks:
      a. Gymnasium: Clean and paint galvanized roof deck, exposed steel structure, exposed ducts, basketball goal suspension framing, conduit, piping, and other exposed appurtenances.
   2. Underside of existing Metal Roofing Panels

D. Unless otherwise indicated, 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. Acoustical wall panels.
      d. Lockers
      e. Toilet compartment doors and partitions.
      f. Prefinished mechanical and electrical equipment, unless roof-top equipment visible from ground level, and equipment specifically noted to be painted.
      g. Light fixtures.
      h. Hardware.

   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.
      e. Pipe spaces.

f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces including the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.

4. 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.

5. 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 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss and satin refer to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 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.

D. Paint and Preparation Schedule: Submit schedule of proposed paint type and sheen for each use and each area or room. Use room names and numbers as appearing in the Architect's drawings, or other identifying information such as "steel framing on existing outdoor walkway cover".

1. Schedule shall include a brief description of preparation requirements for each existing materials condition. "Sanding", "rust-removal", and "cleaning" are all examples of preparation requirements.

2. Schedule shall include which existing materials will receive a primer, and which will rely on existing paint (cleaned and prepared) in lieu of primer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

A. Obtain primers and block fillers from the same manufacturer as the finish coats.

1.7 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.

1.8 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.

1.9 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. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.10 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.

1.11 WARRANTY

A. Section 01 77 00 – Closeout Procedures: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for paints and coatings.

1.12 EXTRA MATERIALS

A. Section 01 77 00 – Closeout Procedures: 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. Benjamin Moore & Co. www.benjaminmoore.com
2. Glidden Professional, www.gliddenprofessional.com
3. PPG Paints www.ppgpaints.com
4. Sherwin-Williams Co. (Sherwin-Williams). www.sherwin-williams.com
5. Substitutions: Section 01 25 00 – Substitution Procedures.

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. Alternate Manufacturers: Sherwin-Williams products are specified. Equivalent products by listed manufacturers are acceptable upon approval by Architect.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish

manufacturer's material data and certificates of performance for proposed substitutions.

H. Colors: As indicated in the Color Schedule in the Drawings.

I. 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.
1. Verify compatibility of finish paint with shop-applied primers.

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. Exterior 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 or existing paint at steel doors and frames.

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 AND FILLERS: Over unpainted new surfaces.

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.

B. Typical Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Sherwin-Williams; *Pro Mar 200 Zero VOC Latex Primer B28W2600 Series*:
2. 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 Including Steel Doors and Frames: 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. Typical Drywall: Interior Low-VOC Latex Enamel: Factory-formulated acrylic-latex interior enamel.
1. Sherwin-Williams: Pro Green 200 Low VOC Acrylic Latex Enamel, B20W600 Series: Applied at a dry film thickness of not less than 1.7 mils.
2. Sheen: Eggshell finish unless different sheen is required to match existing.
3. Apply two (2) coats over specified primer or existing painted finish.

B. Drywall at Corridors: Interior Zero VOC Latex Enamel Factory-formulated acrylic-latex interior enamel.
1. Sherwin-Williams: *Pro Industrial Zero VOC Acrylic Latex Enamel*, B66W650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils.
2. Sheen: Semi-Gloss finish unless different sheen is approved to match existing.
3. Apply two (2) coats over specified primer or existing painted finish.

C. Interior Dryfall Finish Coat: Factory-formulated acrylic finish coat for exposed roof structure, underside of roof deck, piping, ducting, conduit, and other exposed accessories, both unprimed and primed (or existing painted finish).
1. Sherwin-Williams: Waterborne Acrylic Dryfall, B42 Series.

D. Interior Metal including Steel Doors and Frames: Interior Zero VOC Latex Enamel Factory-formulated acrylic-latex interior enamel.
1. Sherwin-Williams: *Pro Industrial Zero VOC Acrylic Latex Enamel*, B66W651: Applied at a dry film thickness of not less than 2.5-4.0 mils.
2. Sheen: Semi-Gloss finish unless different sheen is approved to match existing.
3. Apply two (2) coats over shop primer or existing painted finish.

E. All CMU at Any Location, and Drywall at Wet Areas (shower rooms, restrooms, custodial rooms, and food preparation): Factory-formulated, two-component, waterbased, catalyzed

epoxy resin for high performance applications.
1. Sherwin-Williams: Sherwin-Williams *Waterbased Catalyzed Epoxy B70-200 Series*: Applied at a dry film thickness of not less than 2.5 mils.
2. Sheen: Semi-Gloss finish unless different sheen is approved to match existing.
3. Apply 2 coats over specified primer or existing painted finish.

2.8 INTERIOR WOOD VARNISH

A. Interior Waterborne Polyurethane Varnish: Factory-formulated clear varnish, Gloss or Satin.
1. 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.

~~2. Use where light oil stain where color is needed for newly resealed wood to match existing:~~

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers and mineral spirits as required. Sand surfaces exposed to view smooth and remove dust.
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.

4. 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.

5. 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.
a. For existing galvanized surfaces indicating rust, blast surfaces clean of all rust and thoroughly remove all residue prior to applying specified primer for galvanized material.

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 or adhesion issues 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.

A. 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.

B. 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: 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 77 00 – Closeout Procedures: 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. Metals: Provide the following finish systems over exterior galvanized or non-galvanized metal surfaces indicated to be painted:
1. Steel walkway cover framing, 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, and 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. Satin or Semigloss finish in Classrooms, as selected by Architect.
   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.
      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. Satin or semigloss finish in classrooms, restrooms, custodial closets as selected by Architect.
      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 satin or semigloss low-VOC latex enamel as selected by Architect.

F. Metals: Provide the following finish systems over galvanized or non-galvanized metal surfaces indicated to be painted:
   1. 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.
   2. Field Welds and Cuts in Galvanized Metals: Apply 2-coats of specified zinc-rich coating over wire-brushed and cleaned galvanized metal.

G. Exposed Overhead Structure inside Gyms: Provide the following finish systems over galvanized or non-galvanized metal surfaces indicated to be painted:
   1. All Materials:
      a. Remove all dirt and other superfluous materials by scraping, sanding, and cleaning.
      b. Remove any loose or poorly adhered paint by wire-brushing, then cleaning.
      c. Apply specified primer to any unpainted metals, or metals where rust and/or existing paint has been removed.
   2. Existing Roof Framing and Metal Deck: Apply specified dry-fall paint using spray equipment in two complete passes. Allow for drying between each application.
   3. Miscellaneous mechanical ducts, piping, conduit, equipment supports: Apply specified dry-fall paint using spray equipment in two complete passes. Allow for drying between each application.
   4. Other Surfaces: Mask-off or cover items not to be painted, including walls, windows, and doors. Cover floor for additional protection for dry-fall paint system.

3.9 SCHEDULE - INTERIOR EPOXY WALL 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.

END OF SECTION

SECTION 09 96 53 - ELASTOMERIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of elastomeric coatings to exterior CMU and plaster surfaces as may be indicated within the extents of the project boundary.

1. Exterior masonry screen wall.

2. Exterior plaster soffits.

B. Related Sections:

1. Section 09 90 00 – Painting and Coating:
   a. General preparation and painting requirements.
   b. Block filler for concrete masonry units to be painted.

1.2 PERFORMANCE REQUIREMENT

A. Provide elastomeric coating systems with the following properties as determined by the test methods indicated:

B. Elongation at Break: Not less than 280 percent at 77 deg F and not less than 50 percent at 0 deg F according to ASTM D 412.

C. Low-Temperature Flexibility: Passes a 1/8 inch, 180 degree mandrel bend at minus 15 deg F at 20 mil dry film thickness according to ASTM C 711.

D. Water-Vapor Transmission: Not less than 2.0 perms according to ASTM E 96.

E. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.

F. Minimum Solids Content by Volume: Not less than 45 percent.

1.3 SUBMITTALS

A. Product Data: For each elastomeric coating system specified. Include block fillers and primers.
   1. Material List: An inclusive list of each required coating material. Indicate each material and cross-reference the 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 and instructions for handling, storing, and applying each coating material proposed for use.
   3. Certification by elastomeric coating manufacturer that products supplied comply with local regulations controlling use of VOCs.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative samples of actual substrate.
   1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
   3. Submit samples on the following substrates for the Architect's review of color and texture only:
      a. Concrete, Masonry, and Stucco: Provide two 4 inch (100 mm) square samples of actual substrate material for each color and texture.

b. Concrete Masonry: Two 8 inch (200 mm) square samples of concrete masonry, with mortar joint in the center, for each color and texture.

C. 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.

D. Product Test Reports: From a qualified independent testing and inspecting agency indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last 2 years of current product formulations.

E. Material Certificates: In lieu of agency test reports, when permitted by the Architect, certificates signed by manufacturers certifying that each material complies with requirements specified.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and other undercoat materials from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide full-coat benchmark finish samples of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared Samples. Benchmark finish shall be applied by the Subcontractor responsible for the Project Work.
1. The Architect will select one exterior wall surface to represent surfaces and conditions for each substrate.
   a. Wall Surfaces: Prepare benchmark samples on at least 100 sq. ft. of wall surface.
2. After benchmark samples are approved, these surfaces will be used to evaluate coating systems.
3. Obtain the Architect's approval of benchmark samples before starting application of coatings.
4. Final approval of colors will be from benchmark samples, not samples submitted for verification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing the manufacturer's name and label, and the following information:
1. Product name or title of material.
2. Manufacturer's stock number and date of manufacture.
3. Contents by volume, for pigment and vehicle constituents.
4. Thinning instructions (if permitted).
5. Application instructions.
6. Color name and number.
7. Handling instructions and precautions.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.6 PROJECT CONDITIONS

A. Temperature Conditions: Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F, unless otherwise permitted by manufacturer's written instructions.

B. Weather Conditions: Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.7 WARRANTY

A. Elastomeric Coating Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace elastomeric coatings that fail within the specified warranty period. Failures include, but are not limited to, water penetration through the coating.

B. Warranty Period for Elastomeric Coatings: 5 years from the date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra elastomeric coating materials from the same production run as the materials applied in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the products for each condition indicated in the Coating Schedule, or a comparable product by other manufacturer.

B. Manufacturers Names: The following manufacturers are referred to in the Coating Schedule by use of shortened versions of their names, which are shown in parentheses:
   1. BASF Construction Chemicals (Sonneborn), www.buildingsystems.basf.com
   2. BASF Construction Chemicals (Thoro), www.buildingsystems.basf.com
   3. Kelly-Moore Paints (Kelly-Moore), www.kellymoore.com
   4. PPG Industries, Inc. (PPG Pittsburgh Paints), www.pittsburghpaints.com
   5. Tamms Industries Company (Tamms), www.tamms.com

2.2 CRACK FILLERS

A. Crack Fillers: Provide the manufacturer's standard factory-formulated acrylic emulsion crack fillers that are compatible with substrate and finish coat materials indicated.

B. Products: Subject to compliance with requirements, crack fillers that may be incorporated in the Work include, but are not limited to, the following:
   1. For cracks up to 1/16 inch, provide the following:
      a. Kelly-Moore: 1116 Kel-Seal Brush Grade.
      b. PPG Pittsburgh Paints: Perma-Crete 4-1002/4-1003 Brush Grade.
      c. Sonneborn: Hydrocide 750 Brush Grade or Knife Grade Patching Compound.
      d. Thoro: Thorolastic Knife Grade.
   2. For cracks more than 1/16 inch, provide the following:
      a. Kelly-Moore: 1108 Kel-Seal Knife Grade.
      b. PPG Pittsburgh Paints: Perma-Crete 4-1002/4-1001 Knife Grade.
      c. Sonneborn: Hydrocide 750 Knife Grade Patching Compound.

d. Tamms: Tamms Thin Patch.
e. Thoro: Thorolastic Knife Grade.

3. Block Filler: Reference Section 09 90 00.2.
1. Primer: Reference Section 09 90 00.

2.3 BLOCK FILLERS AND PRIMERS

A. Materials: Block fillers and primers as specified in Section 09 90 00, or by manufacturers listed in this Section. Materials must be approved by the elastomeric coating system manufacturer.

B. Application: As specified in Section 09 90 00 and this Section.

2.4 ELASTOMERIC COATING MATERIALS

A. Material Compatibility: Provide crack fillers, block fillers, primers, elastomeric finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide the manufacturer's best-quality elastomeric coating material complying with requirements of FS TT-C-555. Material containers not displaying manufacturer's product identification are not acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
2. Furnish manufacturer's material data and certificates of performance of proposed substitutions.

C. Colors and Textures: Provide custom colors and textures of the finished elastomeric coating system to match the Architect's samples.

D. Products: Smooth, factory-formulated, 100 percent acrylic elastomeric coatings:
1. Kelly-Moore: 1128 Kel-Seal Smooth Elastomeric Coating.
2. PPG Pittsburgh Paints: 4-110 Perma-Crete Pitt-Flex Elastomeric Coating Smooth.
3. Sherwin-Williams Co: SherLastic Smooth Elastomeric Coating.
4. Sonneborn: Hydrocide colorflex Waterproof Elastomeric Coating.
5. Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
6. Thoro: Thorolastic Smooth Elastomeric Coating.
7. Primer: As recommended by the coating manufactuer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with the Applicator present, under which elastomeric coating systems will be applied for compliance with application requirements. Surfaces to receive elastomeric coatings must be thoroughly dry before coatings are applied.
1. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed by others.
2. Begin application only after unsatisfactory conditions have been corrected and surfaces to receive coating are thoroughly dry.
3. Start of coating within a particular area will be construed as the Applicator's acceptance of surface conditions.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied

protection before surface preparation and coating.

1. After completing coating operations in each area, reinstall items removed, using workers skilled in trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminates will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for the particular substrate conditions and as specified.

1. Cementitious Surfaces: Prepare concrete, concrete masonry, stucco, and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar conditions by water blasting followed by a clear water rinse.
   a. Remove mildew and neutralize surfaces according to manufacturer's written recommendations before patching materials are applied.
   b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
   d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
2. Crack Repair: Fill cracks according to manufacturer's written recommendations before coating surfaces.
3. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initially applying elastomeric coatings.
   a. Cracks up to 1/16 Inch: Clean surface around cracks. Apply primer penetrating cracks as deeply as possible, overflowing crack 2 inches on each side. When primer is dry, apply manufacturer's recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges around cracks over primed area. Allow for sealant shrinkage when applying.
   b. Cracks up to 3/8 Inch: Open cracks to 1/4 to 3/8 inch wide and 1/8 inch deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches on each side of cracks. Fill cracks with manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
4. Material Preparation: Mix and prepare materials according to coating manufacturer's written instructions.
   a. Stir materials before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film that may form into material. Remove film and, if necessary, strain coating material before using.
   b. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within limits recommended by manufacturer.

3.3 APPLICATION

A. General: Apply elastomeric coatings to exposed surfaces indicated, according to manufacturer's written instructions.

B. Labels: Do not paint over UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

C. Scheduling Coating: 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.
   2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
   3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat does not cause undercoat to lift or lose adhesion.

D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for material being applied.
   2. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep's wool covers with a 1 to 1-1/4 inch nap as recommended by the manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for material and texture required.
   4. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness as recommended by the manufacturer.
   5. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of 2 coats in 1 pass.

E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: If recommended by the manufacturer, apply a primer to material being coated before applying finish coats.

G. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

H. Roller Application: Keep the cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.

I. Spray Application: Use spray equipment for application only when permitted by manufacturer's written recommendations and authorities having jurisdiction.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

3.4 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the Project site.
   1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by the Architect. Leave in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
   1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces.

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.

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 77 00 - 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 77 00 – Closeout Procedures: Product warranties and product bonds.

B. Furnish manufacturer's written 5-year warranty for porcelain boards in which Manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within the specified warranty period.

C. Warranty to include the following defects:
1. Coverage of glass surface from discoloration or surface change.
2. Surfaces lose original writing and erasing qualities.
3. Surfaces exhibit crazing, cracking, or flaking.
4. Noticeable deterioration of finish.
5. Writing surface delamination.
6. Fabric tearing, discoloration, or delamination.
7. Unit releasing from substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Claridge Products and Equipment, Inc. www.claridgeproducts.com

B. PolyVision, polyvision.com

C. ADP Lemco, Inc. www.adplemco.com

D. Substitutions: Section 01 25 00 – Substitution Procedures.

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.

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. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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. Install only after wall finishes have been completed.

C. Install with clips or other method to allow for removal without damage to wall finish.

D. Establish top of boards height(s) indicated on Drawings and ensure mounting height requirement of AV system is taken into consideration. Notify Architect in the event of a discrepancy.

E. Secure units level and plumb.

F. Provide continuous bead of clear silicone at top of markerboard where they meet the wall.

G. Coordinate units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 CLEANING

A. Section 01 77 00 – Closeout Procedures: 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 to match style and configuration of existing 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. In addition to drawings, Contractor shall visit each renovation site and document the existing signage. Design intent is to match existing signage to the greatest extent possible. 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 81 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. Architectural Graphic Products www.agpmfg.com
b. South Texas Graphic Specialties, Inc.
B. Substitutions: Section 01 25 00 – Substitution Procedures.

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 II 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 III-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 28 00 - TOILET AND SHOWER ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. The following items are Owner furnished and Contractor installed (CFCI):
   1. Paper towel dispensers/disposal units.
   2. Toilet tissue dispensers.
   3. Soap Dispensers.

B. The following items are Contractor-Furnished and Contractor Installed (CFCI):
   1. Grab bars.
   2. Stainless steel framed mirrors.

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

A. 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.

B. 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 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.
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 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. 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.

D. 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.

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. Type: 16-ga. brushed finish Type 304 stainless steel, surface-mount type. Basis of Design: *Type AG-16-2* as manufactured by Western Fabricating or approved equivalent.
   1. Size: 2" x 2" x 4ft. one-piece length from top of floor base.
   2. Fastening: Flat head stainless steel screws set flush with face.
   3. Provide at outside corners of drywall construction as indicated.

B. Manufacturers:
   1. Western Fabricating, LLC; www.cornerguard.net
   2. Monarch Metal, Inc.; www.monarchmetal.com
   3. Substitutions: Section 01 25 00 – Substitution Procedures.

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. Section 01 77 00 – Closeout Procedures: 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 77 00 – 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 25 00 – Substitution Procedures.

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. Type: Fully-recessed, solid No. 4 polished front stainless steel continuously hinged panel with magnetic catch.

B. Size: To accommodate 10-lb multipurpose dry chemical type extinguisher.

C. Tub: Formed sheet steel, 0.036-inch thick base metal.

D. Doors and Trim: Formed stainless steel sheet.

E. Configuration: Semi-recessed type, sized to accommodate extinguisher.

F. Cabinet Mounting Hardware: Appropriate to cabinet.

G. Form cabinet enclosure with right angle inside corners and seams. Form cabinet interior from stainless steel or factory finished steel one piece with corners mitered, welded, and ground smooth.

H. Pre-drill for anchors.

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. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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 31 13 – Project Coordination: 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 77 00 – Closeout Procedures: 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-Z Shelving Inc. www.e-zshelving.com
   5. Hi-Line Storage Systems Co. www.hi-line.com
   6. Lyon Metal Products, Inc. www.lyon-metal.com
   7. Penco Products Inc. www.pencoproducts.com
   8. Republic Storage Systems www.republicstorage.com
   9. Shelving Solutions, LLC www.shelvingsolutions.com
   10. Spacesaver Corp. www.spacesaver.com
   11. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 COMPONENTS

A. Sheet Steel: Mild, cold rolled and leveled unfinished steel; minimum 18 gage thick.

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. No end panel.
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.
3. Shelf placement: Locate (1) shelf as close to floor as possible.

C. Load Capacities: Minimum load capacity for each shelf shall be as follows:
1. For units up to 36" wide: Minimum 750 lbs. per shelf.
2. For units 42” to 48” wide: Minimum 750 lbs. per shelf.

2.3 SHOP FINISHING: Steel: Manufacturer’s standard baked enamel finish, color as selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Inspect areas and conditions in which metal storage shelving will be installed. Verify locations of power feeds.

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. Secure 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 77 00 – Closeout Procedures: Final cleaning.

B. Clean steel surfaces in accordance with manufacturer’s instructions.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: Protecting installed construction.

B. Do not permit finished shelving units to be exposed to continued construction activity.

END OF SECTION

SECTION 10 70 00
PROTECTIVE COVERS

PART 1 GENERAL

1.1 SUMMARY

A. Work in this section includes furnishing and installing an Outdoor Covered Play Structure over playground area as shown on drawings.

B. Structure shall be steel-framed with factory finish, with gable end roof configuration, designed to withstand local wind loads and suitable for outdoor use.

1.2 RELATED ITEMS AND CONSIDERATIONS

A. Concrete for drilled pier footings with embedded anchor bolts for column support.

B. Coordination with site drainage and adjacent hardscape.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of components, finishes, and accessories.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments; sealed by a structural engineer licensed in Texas.

C. Pier design and layout based on geotechnical report, sealed by structural engineer.

D. Samples for verification: showing full range of color, texture, and finish.

1.4 QUALITY ASSURANCE

A. Shelter must conform to applicable national and local building codes.

B. Manufacturer Qualifications: Minimum 60 years' experience in the manufacturing of protective covers of the type specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store all shelter components in protected areas until the time of installation.

1.6 WARRANTY

A. Minimum ten (10) year manufacturer's system warranty covering defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURER

Basis of Design: Superior Recreational Products Series 8300 Gable End Structure, or approved equal. Other approved manufacturers include: Classic Recreation Systems, or comparable product approved by FBISD Design Manager.

2.2 MATERIALS

A. Steel-framed HSS columns and beams, factory finished for outdoor use.

B. Roof panels: Minimum 24-gauge prefinished steel with concealed fastening system, complying with ASTM A755.

C. Trim, closures, and accessories to match roof finish and design.

2.3 ACCESSORIES

Provide appropriate fasteners and anchors per engineer’s sealed drawings and applicable codes.

2.4 FABRICATION

Fabrication shall comply with industry standards and applicable codes. Components shall be factory fabricated to the maximum extent practicable, requiring only field bolting and minimal field cutting or welding.

2.5 FINISHES

Material and Finish: Formed steel sheet, factory-finished with the specified powder coating, complying with ASTM A755.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions are suitable for installation.

B. Install according to approved shop drawings and manufacturer’s guidelines.

C. Protect finishes during installation and leave area clean.

3.2 INSTALLATION

A. Installation shall be in strict accordance with manufacturer’s shop drawings. General installation guidelines are supplied with each shelter.

B. Particular attention should be given to protecting the finish during handling and installation.

C. After installation, entire system should be left in a clean condition.

END OF SECTION

SECTION 10 73 26 - ALUMINUM WALKWAY COVERS AND CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum walkway covers and entry canopies.
2. Foundations, in form of engineered concrete footings, piers or other appropriate structure.
3. Flashing at connections to buildings.

A. Related Work:
1. Section 04 20 00 - Unit Masonry: Items built into masonry walls.
2. Section 07 90 00 - Joint Protection: Joint sealants.
3. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Use for installation, only personnel who are skilled in the work required, familiar with the manufacturer's recommended methods of installation and the requirements of the work.

B. Engineer Qualifications: Manufacture to engineer each component of system, including foundations, to resist loads indicated and in force by the building code.

C. Engineer of Record:

1. The Engineer of Record shall prepare design calculations, Shop Drawings, and other structural data as required.

2. The Engineer of Record shall perform two (2) site inspections during installation and one (1) site inspection at completion of work.

3. The Engineer of Record shall provide reports, including any nonconformance, issued to the Construction Manager, Owner, and Architect/Engineer within 48 hours of inspection.

1.3 SUBMITTALS:

A. Shop Drawings: Submit Shop Drawings in accordance with Division 1 Section "Submittals".

B. Contractor shall submit shop drawings for approval by the Architect prior to fabrication of any materials. Shop Drawings shall clearly illustrate all details including but not limited to: Plan views, column layout and measurements, footing sizing and details, drainage locations and details, building wall condition details, flashing details, Canopy component sizing and thickness, Fastener sizing, large scale assembly details, and finishes by component.

1. Contractor shall verify all dimensions and elevations prior to submittal to Architect and are to be checked by Manufacturer prior to fabrication.

2. The site-specific shop drawings and calculations shall bear the seal of a Civil or Structural engineer authorized to practice in the jurisdiction where the project is located.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Delete above if colors are preselected and specified or scheduled. Retain below with or without above.

E. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

F. Installation Methods: Submit two copies of manufacturer's recommended installation methods.

1.4 PRE-INSTALLATION MEETING

A. Section 01 81 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 PRODUCT HANDLING

A. Protection: Protect walkway covers before, during and after installation. Protect installed work of other trades.

B. Replacements: In the event of damage, make repairs or replacements as necessary.

PART 2 - PRODUCTS

2.1 GENERAL

A. Designs are based on the product of *AVAdek Walkway Cover Systems*.

B. Manufacturers: Subject to compliance with requirements, provide products of one of the following manufacturers:
1. ASA Builders, Inc., www.asabuildersinc.com.
2. AVAdek Walkway Cover Systems & Canopies www.avadek.com
3. Dittmer Architectural Aluminum; Ditt-Deck Extruded Aluminum Walkway Covers www.ditt-deck.com
4. E.L. Burns Company, Inc.; Burns Walkway Covers www.burnscovers.com
5. Peachtree Protective Covers www.peachtreecovers.com

C. Design Requirements:

1. Systems shall be designed for a minimum 20 psf Live load and 25 psf Wind Uplift Load, or additional should state or local building codes require.

2. Systems shall be designed to withstand a 150-mph wind event.

3. It is the responsibility of the walkway cover/canopy manufacturer to verify the design meets the structural load requirements as specified.

4. Configurations: Reference drawings for configurations of walkway covers and entry canopies (indicated as cantilevered from building structure, or column-supported).

2.2 MATERIALS

A. Beams: “U” Beams sized by manufacturer to meet all required design loads, including wind loads, (minimum 6” x 4” x .125”) Alloy 6063-T6 temper

B. Columns: 8” diameter Schedule 40 extruded aluminum round Alloy 6063-T6 temper.

C. Deck: Sized by manufacturer to meet all required design loads, including wind loads, (minimum 2-3/4” ht. x 6” x .078” thickness); extruded aluminum, Alloy 6063-T6 temper; roll-formed not acceptable.

D. Fascia / Trim: Extruded Aluminum 12”-18” ht. X 3” x 0.125” “G” Alloy 6063-T6 temper

E. The component sizes noted above are minimums and shall be precluded by component sizes called out on the drawings, or larger components as required to achieve the required structural performance.

F. Fasteners: Stainless Steel

G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

H. Miscellaneous:

1. Provide fasteners, sealant, flashing, additional components, etc., to match bents, deck, and trim as required to provide for a complete and finished system.

2.3 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Aluminum Columns, Decking, Fascias, and Primary Framing: AA-M12C22A41 Anodic coating, Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

2. Concealed Secondary Framing/Furring: Any concealed framing above aluminum soffit and below metal decking; Mill finish or specified clear anodized.

PART 3 - EXECUTION

A. Coordinate installation with scheduled concrete, masonry and roofing work.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Erection shall be by manufacturer in accordance with approved Shop Drawings.

END OF SECTION

SECTION 11 61 34 – STAGE CURTAIN REPLACEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes removing and replacing the following types of stage curtains:
   1. Front-setting curtains including house curtain and valance.
   2. Side curtains.
   3. Rear curtains.
   4. Border curtains

B. Properly dispose of removed materials at an appropriate offsite location.

1.2 INTERPRETATION OF DOCUMENTS

A. Governing Clause
   1. For the sake of brevity these specifications shall omit phrases such as “Contractor shall furnish and install” , “unless otherwise indicated or specified” , etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the Owner.

1.3 SUBMITTALS

A. Product Information:
   1. Fabric Samples: Submit sample books of each fabric specified, containing standard colors for pre-selection. More than one color may be selected. After pre-selection submit 12” x 12” samples of each material and color pre-selected for final review.

   2. Equipment List: Submit list and cut sheets of any required equipment, materials, cable or fittings proposed to be provided for ensuring the completed system is safe and fully operational.

   3. Product Certificates: Signed by manufacturers of stage curtains certifying that products furnished comply with requirements. Give name of flame-retardant chemical used, identification of applicator, treatment method, application date, performance life span of treatment, and details of any restrictions and limitations.

B. Fabricator and Installer Qualifications Data: Provide list of completed projects with project names and addresses including contact information of project architects and owners.

C. Shop Drawings: Show layout and types of stage curtains. Include the following:
   1. Stage plan view.
   2. Stage side section view.
   3. Full dimensions of proscenium opening.
   4. Full dimensions of curtains with pleats fully opened.
   5. Details of installation and erection, including adjoining conditions and necessary clearances.
   6. All drawings shall be based on actual job measurements.

1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: The stage curtain contractor shall be fully experienced in the fabrication and installation of stage curtains as specified. The company shall have been in business for a minimum of five (5) full years preceding the installation, performing work similar to that specified. The installer shall employ only fully trained stage riggers for the installation of the stage curtains.

B. Fire-Test-Response Characteristics: Provide stage curtains with the fire-test-response

characteristics indicated, as determined by testing identical products per test method indicated below by UL or a testing and inspecting agency acceptable to authorities having jurisdiction. Permanently attach label to each fabric of curtain assembly indicating that fabric is inherently and permanently flame resistant.

C. Contractor Qualifications: Show layout and types of stage curtains. Include the following:
1. The Contractor shall be fully experienced in the fabrication and installation of the stage equipment as herein specified. The Contractor shall have been in business for five (5) full years preceding the date of this bid doing work similar to the type specified and under the same name. The Contractor shall employ only fully trained stage riggers, electricians and mechanics for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when work is in progress. He shall represent the Contractor and all directions given by him shall be as binding as if given by the Contractor.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for a period of 1-year after date of Substantial Completion of the Project. Warranted defects shall include but not necessarily be limited to:
1. Uneven hanging of curtains.
2. Uneven wear of fabric under normal use.
3. Fading of fabric color under normal use.

1.6 PROJECT CONDITIONS

A. Inspection: Visit the project site prior to bidding to examine existing curtain and track equipment and determine the full scope of materials and labor required to provide a fully operational stage curtain. Additional materials, equipment, cable or fittings determined to be needed after bidding, will be the full responsibility of the curtain installer at no additional cost to the Owner.

B. Field Measurements: Verify stage curtain openings and dimensions of other construction by field measurements prior to fabrication.

C. Coordination: Coordinate construction to ensure that actual opening and construction dimensions correspond to requirements of fabricated work. Coordinate layout and installation of stage curtains with wall construction, proscenium construction, and other equipment and fittings existing or proposed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver materials to the project site until building is enclosed, other construction within spaces where curtains will be installed is substantially complete, and installation of stage curtains is ready to proceed.

PART 2 - PRODUCTS

2.1 CURTAIN SUSPENSION SYSTEMS

A. New curtains shall be installed on existing tracks and battens.
1. Fabricator shall visit each site to determine configuration(s) of curtains, condition and types of suspension systems, and take careful job measurements of existing conditions.
2. Service and repair track as necessary to ensure fully operational curtain system with smooth opening and closing.

2.2 FRONT CURTAIN and VALANCE

A. Fabric: Napped fabric of 100% IFR Polyester Velour; 60” or 62” width:
Prestige Velour: Fabric weighing 23 or 25 oz./linear yard nominal, flame retardancy as supplied by KM Mills Fabrics or approved equivalent.

1. Fabrics used in fabrication of draperies shall be permanently and inherently flameproof with a formula approved Bureau of Standards U.S. Department of Commerce, and finished fabric shall pass such tests as are required by the Fire Marshall of the local Fire Dept. and Owner.
   a. Color: Full color range to be provided. Selections to be made by Architect per campus.
   b. Provide fabrics from the same dye lot for each site.

B. Flameproofing
1. Fabrics used in fabrication of draperies shall be inherently flame retardant as per NFPA 701, and finished fabric shall pass such tests as are required by the Fire Marshall of the local Fire Dept.
2. All curtains shall be fabricated to include a tag attached to the curtain indicating that the materials used are in compliance with applicable NFPA or other standards regarding flame retardant materials for stage curtains.
3. A certificate for each type and color of fabric used shall be furnished to the Owner with closeout documents.
4. Certificate shall state name of Stage Equipment Contractor, type of fabric, and stating that the fabric is inherently flame retardant. It shall also state if further treatments would be required and when. The certificate shall have the signature of an officer or authorized representative of the firm furnishing the draperies.
5. The information on certificate shall be notarized by a Notary Public in the State of Texas.
6. For non-IFR fabrics, flameproof in accordance with the recommendations of manufacturers DuPont, Monsanto, or accepted equal. Materials submitted showing of sprayed flameproofing is unacceptable. Employ non-hydroscopic, non-crystalline agents in the flameproofing process. Flameproof fabrics by immersion for compliance with applicable codes. Perform flameproofing in a manner to minimize stiffness in the fabric. Flameproof all fabrics prior to drapery fabrication. Provide certification of flame proofing.

C. Fabrication
1. Front curtain shall have bi-parting system and shall include fixed 36” high valance unless otherwise noted. Curtain shall be fabricated from two separate equal-width panels that overlap at centerline. Provide job-measurements for each opening height and width.
2. Sew fabrics with box-pleats to 3-1/2" wide heavy-duty upholstery jute webbing, pleats spaced 12" on centers to provide 50% added fullness. Use mercerized cotton thread, minimum weight #16, color to match cloth shall be full length and shall be without splices for entire vertical length of the curtain.
3. Properly join panels smooth and free of puckering at seams, hems, and turn backs.
4. Equip each pleat with a 2" plated harness snap hook mounted to curtain by means of a strap of web-belting to curtain by riveting with not less than 2 tubular rivets per snap hook. Web-belting straps shall pass over front and back sides of pleats, and rivets shall go completely through the web-belting, jute webbing, and all thickness of curtain fabric. Canvas straps, leather straps, grommets and s-hooks, cotter key hooks, etc., shall not be acceptable.
5. Bottom hems of all curtains shall be 5" and shall be equipped with a separate canvas pocket sewn inside bottom hems in such manner as to have the bottom of the canvas pocket at least 1-1/2" above bottom of curtain hem. Load canvas pocket with #6 galvanized pump chain, secured to prevent bunching and shifting within the pocket.
6. Vertical hems of all masking curtains shall be 1/2 width. Vertical hems for valances shall be minimum 3”.
7. Finish curtains properly in the best manner and method of the industry, and after hanging, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles shall be allowed to fall our naturally.
8. Properly join panels smooth and free of puckering at seams, hems, and turn backs.

2.3 REAR, SIDE CURTAINS AND BORDER CURTAINS

A. Fabric: Napped fabric of 100% IFR Polyester Velour; 60” or 62” width:
Prestige Velour: Fabric weighing 15 oz./linear yard nominal, flame retardant. as supplied by KM Mills Fabrics or approved equivalent.
1. Color: Opaque black matching approved samples.
2. Provide fabrics from the same dye lot for each site.
3. Inherently and permanently flame resistant.

B. Fabrication:
1. Rear and Side curtains shall each be fabricated from two separate equal-width panels that overlap minimum 12-inches at centerline.
2. Provide 50% added fullness
3. Properly join panels smooth and free of puckering at seams, hems, and turn backs.
4. Provide snap hooks mounted to curtain by means of a strap of web-belting to curtain by riveting with not less than 2 tubular rivets per snap hook.
5. Provide 12” side hems and 5” bottom hems
6. Finish curtains properly in the best manner and method of the industry, and after hanging, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles shall be allowed to fall our naturally.
7. Tie Lines: Provide new tie lines of braided soft cotton, black color; not less than 5/8- inch wide by 3-inches long.
8. Include fixed 24” high border unless otherwise noted.
9. Provide 3” side hems to border curtains.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine inserts, clips, blocking, or other existing supports or those installed by others under this Contract that support tracks and battens. Advise Architect of any unsatisfactory conditions and proceed with installation only after corrections have been corrected.

B. Minor corrections and servicing of existing suspension systems shall be provided under this Contract without additional charge to the Owner

3.2 INSTALLATION

A. Prior to installation, the site must be climate controlled, clean and dust free.

B. All construction, sanding, painting, spraying must be complete prior to curtain installation.

C. Batten Hung: Secure curtains to pipe battens with new tie lines.

D. Track Hung: Secure curtains to track carriers with track manufacturer's special heavy-duty S-hooks or snap hooks.

E. Contractor to provide floor protection while using any lifts or ladders to protect existing floors. Any damage to existing ceilings or walls to be repaired.

3.3 PROTECTION AND CLEANING

A. Protect installed curtains from damage during construction. Provide final cleaning and vacuuming of all construction dust at time of building acceptance

B. Remove and replace any damaged components or entire unit as required to provide curtains in like-new, undamaged condition.

3.4 INSTRUCTION

A. Installer shall test system thoroughly for proper operation and instruct Owner's personnel in

adjusting, operating, and maintaining stage curtains and tracks. Designated instruction time shall be coordinated with the Owner.

END OF SECTION

SECTION 11 66 00 – ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following types of athletic equipment as shown on the Drawings:
1. Volleyball floor inserts and standards.
2. Volleyball equipment.
3. Protective wall padding.
4. Outdoor soccer goals.

B. Related Sections:
1. Section 11 66 24 – Basketball Backstops: Suspended basketball goals.

1.2 QUALITY ASSURANCE

A. For installation use 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 and durability characteristics for each type of gymnasium equipment and accessory specified.

C. Installation Methods: Submit two copies of manufacturer's recommended installation method showing all requirements for blocking and bracing.

D. Shop drawings showing location and extent of athletic equipment and accessories. Include plans, elevations, large-scale details of anchorages, and accessory items. Indicate unit conditions at openings, typical and special details, and location and installation requirements for hardware and operators.

E. Template drawings prepared by manufacturer showing location of items supported or anchored by permanent construction.

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 MANUFACTURERS

A. Unless otherwise indicated, provide Athletic Equipment by the following manufacturers:
1. Aalco Manufacturing Co., www.aalcomfg.com.
2. ADP Lemco, www.adplemco.com
3. Basketball Products International, www.basketballproductsinternational.
4. Douglas Industries, Inc., www.douglas-sports.com.
5. Gill Athletics, Inc., www.gillathletics.com
6. Performance Sport Systems, www.perfsports.com.
7. Porter Equipment Co., www.porterathletic.com.
8. Sports Imports, www.sportsimports.com.
9. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 EQUIPMENT

A. Volleyball Equipment:
1. Inserts: 3-inch I.D. steel sleeve with screw-down flange pre-drilled to receive cast brass, flush mounted floor plate with hinged access door.
a. Model: *Sports Imports KA-25*-S floor plate and *DE5300* sleeve (no

substitutions).
b. Designed for mounting in cored thickened concrete sub-slab with wood flooring.

2. Standards: 3-inch O.D. carbon fiber uprights to fit specified inserts, with safety pads: 2-pair.
   a. Model: *Sports Imports SI-1* (no substitutions) all-carbon telescoping upright with steel pin-stop net height adjustment with 20 permanent net height settings from 6’-6” to 8’-2”.
      (1) Maximum weight 19 lbs.
      (2) Finish: Black polyurethane.
      (3) Clear polycarbonate pulley wheel.
      (4) Non-skid, non-marking rubber bottom.
      (5) Lifetime performance warranty.
   b. Provide *Model HDNR-B Heavy Duty* net ratchet designed for use with specified upright. Provide one unit with removable crank for each pair of uprights
   c. *Model FP-1* triangle-sectioned vinyl-covered foam safety pads with Velcro straps. Color(s) as selected by the Owner. Provide one unit for each upright.
   d. Provide WR-10 wall-mounted storage rack for each pair of uprights. Install at locations as directed by the Architect.

3. Protective Wall Padding:
   a. Basis-of-Design: Wall wainscot padding *Porter No. 90350-326* or approved equivalent by specified manufacturer.
   b. Provide protective wainscot wall padding, 2-ft. wide x 7-ft high x 2-in.thick 6-lbs density urethane foam filled panels, covered with nylon reinforced vinyl fabric, fire retardant, color to be selected by Architect. Backing shall be 7/16" thick plywood or OSB. Ends to be finished with no lip. Where indicated provide special shaped column covers and cut-outs for outlets, and other utilities.
   c. Provide all related accessories required for installation. Mechanically anchor Wall Padding to walls concealing anchors. No lip shall be exposed beyond the edge of the padding. Use separate top pad, Velcro attached to anchor strip to conceal anchors. Locate bottom of pads 8" above finish floor.

4. Outdoor Soccer Goals:
   a. Basis-of-Design: Where indicated on drawings, match existing for manufacturer and model number, and color(s). No substitutions.

PART 3 - EXECUTION

3.1 GENERAL
   a. 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.
   b. Discrepancies: In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.
   c. Installation: Install where indicated, anchoring all components firmly in place in complete accordance with approved shop drawings and the manufacturer's recommendations.

3.2 Volleyball Equipment: Assemble all equipment and demonstrate to Owner prior to Substantial Completion.

END OF SECTION

SECTION 11 66 24 - BASKETBALL BACKSTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basketball backstops.
   2. Backboards.
   3. Goals and nets.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Supplementary framing.
   2. Section 11 66 00 –Gymnasium Equipment.

1.2 REFERENCES

A. National Federation of State High School Associations:
   1. NFHS - Basketball Rules Book.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Indicate size and location of backstops, mounting details, accessory anchoring members.

C. Product Data:
   1. Submit data indicating materials of construction, thicknesses, colors available.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include the following.
   1. Parts catalog with complete list of replacement parts.

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 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept backstops on site in manufacturer's original packaging. Inspect for damage.

C. Store backstops under cover, protected from weather and contamination until installed.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish manufacturer’s lifetime warranty for backboards. Minimum 10-year warranty for framing structure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Porter Equipment Co., www.porterathletic.com.
B. Draper, Inc. www.draperinc.com
C. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 INTERIOR BASKETBALL COURT GOALS

A. Center strut design, suspended from overhead building structural frame to support. Porter Model No. 312 or equal. Height adjustable, Manual operation.
   1. Tubular steel center post mast, approx. 6 in. dia., welded and bolted construction, designed to minimize sway and vibration during play; painted finish.
   2. Furnish manufacturer's standard hardware for backstop mounting.
   3. Furnish supplemental steel framing to span between building structural frame and support backstop at position indicated on Drawings.
   4. Steel framing factory painted in color as selected by the Architect.

B. Main Court Backboards: 72-inch x 42-inch rectangular backboard, 1/2-inch thick clear tempered glass, resiliently mounted in painted steel frame; target markings fired onto glass; furnish bolt-on safety padding along lower edge and corners.
   1. Basis-of-Design: Porter No, 00208 rectangular glass backboard with No. 00326 bolt-on safety pad.
   2. Install at ends of main court.

C. Secondary Court Backboards: Fan Fiberglas Backboard with Backing plate.
   1. Basis-of-Design: Porter No, 00267-000.
   2. Install at sides of main court.

D. Goals: Steel, removable type; fabricated from 5/8-inch rod; 18 Inches inside clear diameter; with no-tie style net hooks; painted finish.
   1. Basis-of-Design: Porter No. 00201-H00 Super-Flex Goal.

E. Net: Woven, size and style to fit goal; 15 to 18 inches long.
   1. Chord Net: Nylon.

2.3 FABRICATION

A. Fabricate components in largest practical sizes for delivery.

B. Provide fittings and hardware to accommodate site assembly and installation. Unpainted fittings and hardware for outdoor assemblies to be hot-dip galvanized or stainless steel.

C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify walls and structures are ready to receive backstops.

C. Verify that installed wood mounting plates are secure for wall-mounted units.

D. Verify electrical power is available with required characteristics for folding units.

E. Verify finishing operations, including factory finishing, are complete before installing backstops.

3.2 INSTALLATION

A. Install backstops in accordance with NFHS requirements.

B. Assemble components furnished loose for field assembly.

C. Install backboards plumb, level, and parallel to basketball court end line.

D. Install goals level and at elevation indicated.

E. Touch up damaged finishes to match shop finish.

3.3 ADJUSTING and CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

END OF SECTION

SECTION 11 68 13
PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Playground Structures and Equipment:
   1. Playground structures.
   2. Provide one set of swings that are 8 bays per set.
   3. Surfacing.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 05 50 00 - Metal Fabrications.

C. Section 06 10 00 - Rough Carpentry.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data:
   1. Manufacturer's data sheets on each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.

C. Verification Samples: Two representative units of each type, size, pattern, and color.

D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.5 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 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 recommended limits.

1.8 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 PRODUCTS

2.1 PLAYGROUND STRUCTURES AND EQUIPMENT

A. Playground Structures and equipment:

1. Playground (monkey bars are not permitted) with rubberized surface and metal shade structure over playground. ADA: Yes.
   a. Ages: 5-12 years. (Minimum capacity: 75 individuals.) for Palmer Elementary School and Rosa Parks Elementary School.
   b. Ages: 2-5 years for Hunter Glen Elementary School.
   c. Color selection to be coordinated through FBISD Project Manager with school Principal.
2. Approved Manufacturer:
   a. Playscapes. Mark Reynolds, Tel:713-417-2692; Email:MarkR@kraftsmanplay.com
   b. Little Tykes.
      Patrick Stallings, Tel:281-299-9450;
      Email: patrick@allplayinc.com
   c. Superior.

B. Surfacing:

1. Composition: Blend of recycled SBR and EPDM rubber, particles and binder, forming a wearing and cushioning product.
2. Binder: Weather resistant, UV stabilized, flexible, non-hardening, 100 percent solids polyurethane. Critical Height: 6 feet (1.8 m).
3. Overall Thickness: Not less than required for critical height indicated.
4. Primer/Adhesive: Primer and weather resistant, moisture cured polyurethane adhesive suitable for unit, substrate, and location recommended and warranted by manufacturer. Color(s):
5. Selected by Architect and incorporated into documents prior to bidding.
6. Leveling and Patching Material: Portland cement based grout or epoxy or polyurethane based formulation suitable for exterior use and approved by protective surfacing manufacturer.
7. Approved manufacturer:
   a. Child Safe Products, Inc.
   b. Game Time; a PlayCore, Inc.
   c. Hanover Specialties, Inc.
   d. No Fault Sport Group, LLC.
   e. Play Safe Surfacing, Inc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly constructed and prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer’s recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

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 for mounting of louver blinds.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts: Aluminum storefront frames for mounting of louver blinds.

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 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 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: 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: 2-inch.
2. Thickness: 9-gauge minimum.
3. Color: As selected by Architect from manufactures full range.

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, plus or minus 1/8 inch.
   2. Blind units installed outside jambs, or at openings requiring multiple blind units: Width and length as indicated, with terminations occurring at centerlines of mullions.

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. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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, and located so exterior louver edges in any position are not closer than 2 inches to interior face of glass. Install intermediate headrail support as required to prevent deflection. Allow clearances between adjacent blinds and for window operating hardware, if any.

B. Secure in place with flush countersunk fasteners.

3.3 ADJUSTING

A. Section 01 77 00 – Closeout Procedures: Testing, adjusting, and balancing.

B. Adjust blinds for smooth operation.

3.4 CLEANING

A. Section 01 77 00 – Closeout Procedures: 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 solid surface countertops assembled from stock components where indicated.

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.

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 81 19 – Project Meetings: 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. Solid Surface Countertops:
1. Refer to Section 12 36 61.

E. Reference 2.4 Fabrication and 3.5 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.

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 31 13 – Project Coordination: 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 77 00 – Closeout Procedures: Testing, adjusting and balancing.

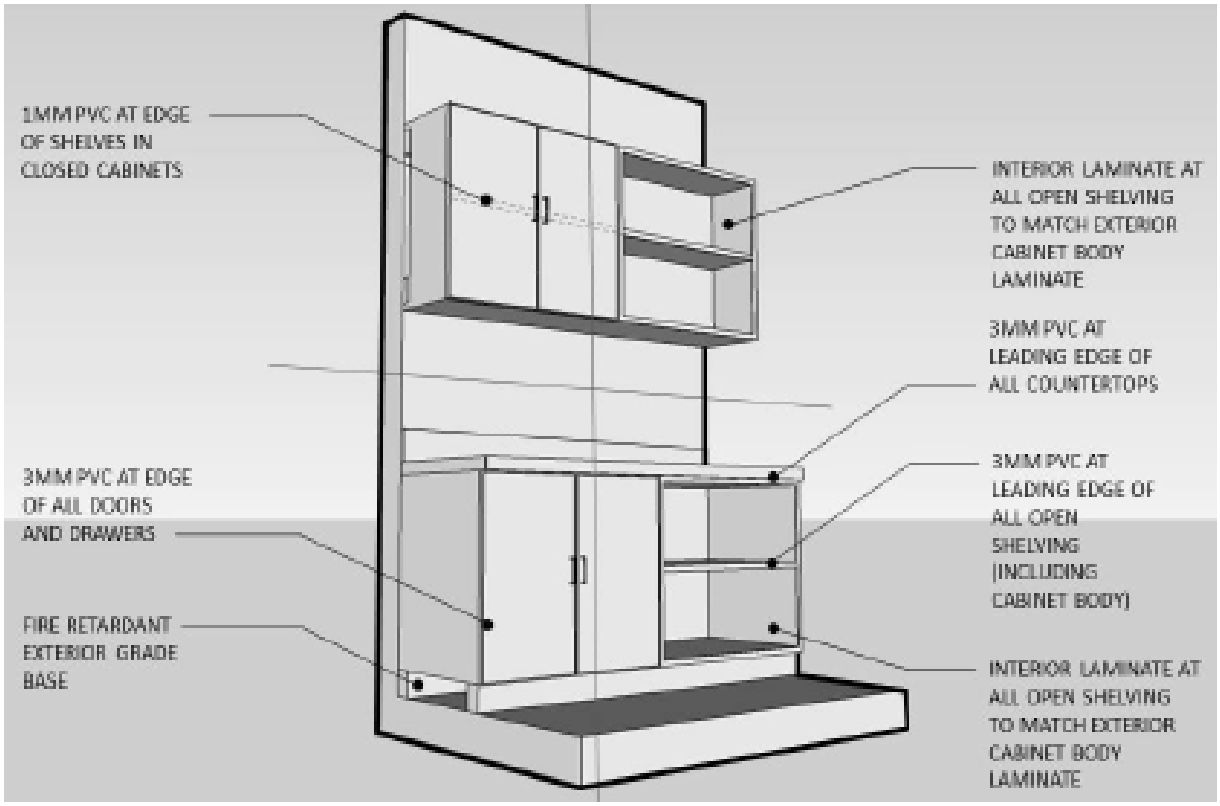
B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Section 01 77 00 – Closeout Procedures: Final cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.5 TYPICAL COMPONENTS DIAGRAM



END OF SECTION

SECTION 12 36 61 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid simulated stone countertops and splashes.

B. Related Sections:
   1. Section 09 30 00 – Tiling: Solid surfacing thresholds at restroom openings.
   2. Section 12 32 16 - Plastic Laminate-Clad Casework: Cabinets receiving countertops.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For countertop materials.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

D. Samples: For the following products:
   1. Countertop material, 6 inches square.
   2. One full-size sample of each simulated stone countertop, with front edge, 8 by 10 inches, of construction and in configuration specified.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Countertops: 3/4 inch thick, solid material with front edge built up with same material.

B. Splashes: 3/4 inch thick, material to match countertop.

C. Fabrication: Fabricate tops in one piece with shop-finished edges unless otherwise indicated. Comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with loose splashes for field assembly.

2.2 COUNTERTOP MATERIALS

A. Basic Material: Homogeneous solid sheets of recycled glass or quartz chips in a Portland cement matrix, complying with ANSI SS1.
   1. Manufacturers:
      a. Caesarstone.
      b. E. I. du Pont de Nemours and Company.
      c. Formica Corporation.
      d. Top Master, Inc., www.topmasterinc.com.
      e. LG Chemical, Ltd.
      f. Substitutions: **Section 01 25 00 – Substitution Procedures**.

2. Basis of Design: *Corian Quartz* as manufactured by duPont or approved equivalent in color, pattern, and finish by specified manufacturer.
   a. Flexural Strength: 5,300 psi or greater per ASTM D790.
   b. Compression Strength (Dry): 27,000 psi per ASTM C170.
   c. Hardness: 7 on Mohs' Hardness Scale.
   d. Stain Resistance: Passes ANSI Z124.6.
   e. Fungal and Bacterioal Resistance: No growth per ASTM G21 and G22.
   f. High Temperature Effect: None-to-Slight per NEMA LD 3.3.6.
   g. Point Impact: Passes ANSI Z 124.6.4.2.
   h. Abrasion Resistance: 139 per ASTM C501.
   i. Water Absorption: 12% maximum per ASTM C373.
   j. Flammability: Rated Class l and Class A per ASTM E84, UL 723, and NFPA 255.
3. Color(s) and Pattern(s): As indicated.

B. Adhesives: Adhesives shall not contain urea formaldehyde.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   1. Install backsplashes and end splashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

END OF SECTION



09.24.2025

Project Manual

September 24, 2025

STANTEC Project No. 21400 1246

FBISD BP022 Gym Renovations & Additions

Fort Bend Independent

School District

Sugar Land, Texas

100% Construction Documents

Issue for Bid and Permit

Volume 2 of 2

All required Permits must be obtained before Construction

SECTION 00 01 01 – PROJECT TITLE PAGE

TITLE AND LOCATION OF THE WORK:

FBISD BP022 – Gym Renovations & Additions

NAME AND ADDRESS OF THE OWNER:

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



09.24.2025

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PEA GROUP
LANDSCAPE ARCHITECT
16060 Dillard Dr, Suite 250
Houston, TX 77040
713-688-3530

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
CONTRACT DOCUMENTS

DOCUMENT 00 01 10 – MASTER TABLE OF CONTENTS

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DIVISIONS 00 – OWNER DOCUMENTS: Bidding Requirements and Contract Forms for Competitive Sealed Proposals (CSP)

*Fort Bend ISD CSP Advertisement for Competitive Sealed Proposals
*Fort Bend ISD CSP Instructions to Bidders
*Fort Bend ISD General Provisions for Purchasing Solicitations and Contracts
*Fort Bend ISD Package A Base Bid Proposal Form
*Fort Bend ISD Package B Alternates Bid Proposal Form
*Fort Bend ISD Clarification for Package B of Fort Bend ISD CSP
*Fort Bend ISD District Required Forms for CSP
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 Insured Parties)
Govt. Code 2270.002, Relationships With Foreign Entities (Required)
Addenda Acknowledgement Form (Required)
*Fort Bend ISD Bonding Capacity Certification Letter *(Required)*
*Fort Bend ISD Conflict of Interest Questionnaire



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*00 31 26	Asbestos Reports – Hunters Glen, Palmer & Ridgegate ES	Owner Document
*00 31 32	Geotechnical Data – Hunters Glen, Palmer & Ridgegate ES	Owner Document

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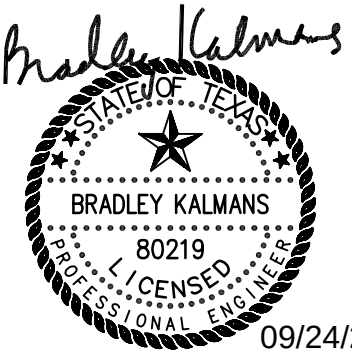
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SECTION 21 01 00
FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11".
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number.
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer
      2) Maintenance contractor as appropriate
      3) Identify area of responsibility of each
      4) Local source of supply for parts and replacement
   d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product
   b. Annotate each sheet to:
      1) Identify specific product or part installed
      2) Identify data applicable to installation
      3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems
      2) Control and flow diagrams
   b. Coordinate drawings with information in Project Record Documents to

assure correct illustration of completed installation.
c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:
a. Organize in consistent format under separate headings for different procedures.
b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
a. Provide information sheet for Owner's personnel, giving:
1) Proper procedures in event of failure
2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
a. Description of unit and component parts
1) Function, normal operating characteristics, and limiting conditions
2) Performance curves, engineering data and tests
3) Complete nomenclature and commercial number of replaceable parts.
b. Operating procedures:
1) Start up, break-in, routine and normal operating instructions.
2) Regulation, control, stopping, shut down and emergency instructions.
3) Summer and winter operating instructions.
4) Special operating instructions.
c. Maintenance procedures:
1) Routine operations
2) Guide to trouble-shooting.
3) Disassembly, repair and reassembly.
4) Alignment, adjusting and checking.
5) Routine service based on operating hours.
d. Servicing and lubrication schedule. List of lubricants required.
e. Manufacturer's printed operating and maintenance instructions.
f. Description of sequence of operation by control manufacturer.
g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
1) Predicted life of part subject to wear.
2) Items recommended to be stocked as spare parts.
h. As installed control diagrams by controls manufacturer.
i. Complete equipment internal wiring diagrams.
j. Each Contractor's coordination drawings.
k. As installed color coded piping diagrams.
l. Charts of valve tag number, with location and function of each valve.
m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 21.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

9. Provide backflow preventer certified test reports.

END OF SECTION

SECTION 21 05 00
FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and 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 has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
9. Exact location of all electrical equipment in and outside of the building.
10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and

operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
   1. Provide the training during the Owner's regular working day.
   2. The instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 4 hours dedicated instructor time.
   2. 2 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 21 05 10
FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 05 12
FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings

2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name and address
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns

2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 05 13
ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for fire protection equipment.
2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.

D. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.

E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for fire protection equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:

C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer’s instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 21 05 14
FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor’s responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse, or abandon.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.

D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner’s review and salvaged by Contractor.

F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.

C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.

D. Remove and replace existing fire protection systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.

E. Refer to other drawings series for work in remodeled areas. Where facilities in these

areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.

F. Remove and replace existing piping coincident with the construction.

3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK

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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.

D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing fire protection installation, or as specified.

H. Existing fire protection piping, and devices found to need additional hangers installed shall be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description “existing”. Provide new nameplates for all existing equipment in renovated areas as specified in Section 21 05 00 Fire Protection General Provisions.

END OF SECTION

SECTION 21 10 00
FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs, and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.

B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.

C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.

D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor’s detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.

E. Do not exceed 52,000 square feet of building for each individual sprinkler system.

F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20

G. It shall be the fire protection installer’s responsibility to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure, and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.

H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.

I. Study the general, structural, electrical, and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.

B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state, and federal fire authorities.

B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.

C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.

B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.

C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.

D. Provide ¼ scale drawings to show the location of the water entry into building with all zone valves, and shut-off valves, with alarms and drains at this location. Prepare the sprinkler drawings under the work of this Section.

E. Submit samples of all sprinkler types for approval.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Johnson Controls (Tyco Fire Products)
   1. Gem/Grinnell
   2. Central
   3. Star Sprinkler

B. Automatic Sprinkler Company of America

C. Potter Roemer, Inc.

D. The Reliable Automatic Sprinkler Company

E. Viking Corporation

F. Victaulic Company of America

G. Globe Fire Sprinkler Corporation

2.2 PIPING AND FITTINGS

A. Above Slab Inside Building
1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
a. Schedule. 40, black steel pipe joined with rolled grooved fittings.

B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.

C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.

D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance with the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

2.3 SPRINKLER HEAD

A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.

B. All heads shall be UL listed and/or FM approved and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with “O” ring design shall not be acceptable.

C. Exposed areas:
1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
2. Tyco Model B, FRB, Globe Model GL-QR, GL-SR, or approved equal

D. Sidewall applications:
1. Horizontal sidewall type with brass finishes and chrome escutcheon.
2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
3. Tyco Model B, FRB, Globe Model GL-QR/SW, GL-SR/SW, or approved equal.

E. Suspended ceilings:
1. Adjustable drop-down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
2. Color of plate, selected by Architect
3. Tyco Series RFII; Series ELOC, Globe Concealed Models GL-QR/INCH, GL-

SW/INCH and GL-INCH/ECLH or approved equal.

F. Dry sprinklers heads at freezers and coolers
   1. Tyco Model DS-1, DS-2, or approved equal.

G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed heavy duty bolt on guards. Bulb type sprinklers will not be acceptable for these locations.
   1. Storage rooms with exposed structure.
   2. Gymnasiums.
   3. Mechanical and Electrical rooms.
   4. Below exposed stairs.
   5. Exposed structure areas.

I. Systems serving walk-n freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer's recommendation with respect to freezer ambient temperatures expected.

2.4 INSPECTOR'S TEST CONNECTION

A. Provide inspector's test connection as required by NFPA 13.
   1. Ductile iron module housing with combination sight glass, orifice, and bonnet assembly
   2. UL listed
   3. Victaulic No. 718
   4. Globe Model UTD
   5. Tyco, or approved equal

2.5 TAMPER SWITCH / SUPERVISORY SWITCH

A. Tamper switch on each valve
   1. Controlling or shutting off sprinkler system or any portion thereof.
   2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
   3. Switch shall be compatible with installed valve for standard mounting.
   4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.6 FLOW SWITCH

A. Vane type flow switch.
   1. Self-contained pneumatic, adjustable retard.
   2. Two, single pole, double throw switches.
   3. Red enamel tamper proof switch housing with flow paddle.
   4. Potter Roemer Model No. 6200 or approved equal.

2.7 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.8 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

2.9 DRY PIPE SYSTEM

A. General: Provide a UL listed, and FM approved dry pipe system at areas subject to freezing. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.

B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756, Globe Model RCW.

C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.

D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.

E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.

F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.

G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.

H. Provide an accelerator when system capacity exceeds 500 gallons.

I. Provide a water motor alarm or electric pressure switch.

J. Provide dry pipe valve trim and pressure gauges.

K. Dry pipe system shall be hydraulically calculated for the hazard being protected.

L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.

M. Provide a test drain valve sized per NFPA. An inspector’s test shall be provided at each system.

N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.

O. The following accessories shall be provided where required:
1. Victaulic Series 756.
2. Viking Model E dry pipe valve with conventional trim.
3. Viking Model D-1 accelerators.
4. Globe Model RCW dry pipe valve with conventional trim package, and Model C Accelerator.

2.10 GASKETS

A. Use 1/16-inch-thick preformed synthetic rubber bonded.

2.11 COUPLINGS

A. Use listed rolled grooved mechanical couplings to engage and lock grooved, or shouldered pipe ends and to allow for some angular deflection, contraction, and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.12 VALVES

A. Use valves suitable for 175 psig WOG.

B. Valves to be UL listed and FM approved.

C. Valve Connections:
1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
2. Screwed ends for pipe sizes 2 inches and smaller.
3. Flanged ends for pipe sizes 2-1/2 inches and larger.
4. Solder or screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

D. Gate Valves:
1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.

E. Check Valves:
1. Up to 2-inch, bronze, regrind bronze swing disk, solder, or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
2. Over 2-inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or approved equal.

F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.

G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

2.13 ELECTRIC ALARM BELL

A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell,

UL listed, red enamel steel, manufactured by Simplex, or approved equal.

2.14 GAUGES

A. Gauges shall be bourdon tube type with minimum 4-1/2-inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.

B. Gauges shall have ¼ inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.

C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.

D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.

E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.

F. Manufactured by:
1. Trerice Model No. 4500 Series
2. Ashcroft
3. Marsh
4. Weksler

2.15 SPARE SPRINKLER HEAD BOX

A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.16 ALARM CHECK VALVE

A. Provide UL listed check valve.
1. Variable for City Supplied systems pressure trim set.
2. Constant for Fire Pump Systems pressure trim set.
3. Tyco AV-1, Globe Model H, or approved equal.

2.17 WATER MOTOR ALARM

A. Provide a red enamel motor alarm for installation on exterior wall.
1. Tyco Model WMA-1, Globe Model WM, or approved equal.

2.18 SIAMESE FIRE DEPARTMENT CONNECTION

A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
1. Provide a 4" X 2-1/2" x2-1/2".
2. Potter-Roemer #5751

PART 3 - EXECUTION

3.1 DESIGN

A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.

B. Uniform discharge density design shall be based on hydraulic calculations using 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 and Williams formula.

D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting, or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.

B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.

C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” on center, minimum 6 inches and maximum 12 inches from glazing.

E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

3.3 PREPARATION

A. Ream pipes and tubes, clean off scale, rust, oxide, and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Pipe beveled each end, per approved procedures.

C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.4 CONNECTION

A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint

compound applied to male threads only.

B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.

C. Clamp cast iron water pipe at fittings with ¾ inch rods and properly anchor and support.

D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.

B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.

C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.

B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.

C. Locate system drains and inspector’s test connections in utility rooms, mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.

D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.

E. Locate outside alarms on wall of building and coordinate with Architect.

F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.

G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.

H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings.

I. Provide Easy-Flex or Flexhead Industries sprinkler hose fittings for each sprinkler head installation for hydraulically designed wet, pre-action, deluge, or dry pipe sprinkler connections per NFPA 13. Allow a 3” minimum bend radius per UL.

J. Install pipe markers to identify fire protection.

K. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.

L. Install fire 2-1/2-inch department valve, maximum 5 feet above floor, complying with NFPA 14.

M. During construction, make one standpipe outlet available on each floor without delay, for fire department use.

N. Provide 3-way standpipe outlets above roof.

O. Provide pressure gauges at the top of each standpipe as detailed on the drawings.

P. Provide drain for each standpipe.

Q. Install valves with stems upright or horizontal, not inverted.

R. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.

S. Install the complete fire sprinkler system in accordance with the approved shop drawings.

T. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish, and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.

U. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.

V. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).

W. Do not install exposed piping below structure in public area.

X. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

3.8 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved adjustable ring type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved adjustable ring type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

3.9 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable ring type hangers shall be used for single pipe supports; Erico Model 115 NFPA UL/FM. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. All parts shall be zinc plated carbon steel, or galvanized.

3.10 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16-gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and airtight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.11 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge, and circulate.

3.12 FLUSHING AND TESTING

A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.

B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.

C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.

D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.13 EXCAVATING, TRENCHING, AND BACKFILLING

A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows, and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows, and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. Both sides of penetrations through walls, floors, and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for

Identification of Piping Systems".

3.15 TESTING AND ACCEPTANCE

A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.

B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.16 TRAINING

A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

SECTION 22 01 00
PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
a. Size: 8-1/2 inch x 11 inch.
b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
a. Provide reinforced punched binder tab and bind in text.
b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
a. Title of Project
b. Identity of separate structures as applicable.
c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
a. Contractor, name of responsible principal, address and telephone number.
b. A list of each product required to be included, indexed to content of the volume.
c. List with each product, name, address and telephone number of:
1) Subcontractor or installer.
2) Maintenance contractor as appropriate.
3) Identify area of responsibility of each.
4) Local source of supply for parts and replacement.
d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
a. Include those sheets pertinent to the specific product.
b. Annotate each sheet to:
1) Identify specific product or part installed.
2) Identify data applicable to installation.
3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
a. Supplement product data with drawings as necessary to illustrate:
1) Relations of component parts of equipment and systems.
2) Control and flow diagrams.
b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:

a. Organize in consistent format under separate headings for different procedures.
b. Provide logical sequence of instructions for each procedure.

5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure.
      2) Instances that might affect validity of warranties or bonds.
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts.
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions.
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer.
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Each Contractor's coordination drawings.
   k. As installed color coded piping diagrams.
   l. Charts of valve tag number, with location and function of each valve.
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 22.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.
10. Provide gas piping pressure test reports.

END OF SECTION

SECTION 22 05 00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of

various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain three sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (two sets are for the Owner's use and one set is for the Architect / Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
6. Indicate exact location of all underground plumbing and flow line elevation.
7. Indicate exact location of all underground plumbing piping and elevation.
8. Indicate exact location of all underground electrical raceways and elevations.
9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
12. Exact location of all electrical equipment in and outside of the building.
13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
15. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect /

Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 8 hours dedicated instructor time.
   2. 4 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect / Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect / Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions

which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 22 05 10
PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 05 12
PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼ inch = 1 foot - 0 inch.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings
2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name and address
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
    a. Contractor
    b. Subcontractor
    c. Supplier
    d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect/Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 05 13
ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for plumbing equipment.
2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.

F. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.

G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for plumbing equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:

C. Temperature Rating. Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for ¾ hp and larger, and provide capacitor-start single-phase motors for ½ hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide two separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and

similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 05 14
PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor’s responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.

D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner’s review and salvaged by Contractor.

F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.

C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.

D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.

E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.

F. Remove and replace existing piping coincident with the construction.

G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.

H. Relocate all domestic piping as required to accommodate new work requiring precedence.

I. Remove concrete housekeeping pad where materials or equipment have been removed.

J. Remove all known utilities that do not provide service to the buildings that remain.

K. Remove existing plumbing vent penetrations through roof not to be reused.

3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.

D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.

H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description “existing”. Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION

SECTION 22 05 15
PLUMBING EARTHWORK

PART 1 - GENERAL

A. Excavate and backfill for pipe trenches for underground piping and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate trenches for underground piping to the required depth to ensure 2-foot minimum coverage over piping.

B. Cut the bottom of the trench or excavation to uniform grade.

C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.

D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.

B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95 percent of maximum soil density as determined by ASTM D-698 Standard Proctor.

C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.3 DISPOSAL OF EXCESS MATERIAL

A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner/Architect.

END OF SECTION

SECTION 22 05 16
EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE BUILDING SLAB

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.

B. Refer to Instructions to Bidders for substitution of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.

B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork

B. Water Distribution

C. Sanitary Sewer

D. Plumbing

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
   2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
   4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

B. City Standards

C. Local Governing Agencies

D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.

B. Sand: Clean, local sand

C. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:
1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.

B. Storm and Sanitary Sewer Trenches:
1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

C. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.

D. Water Line Trenches:
1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.2 PIPE BEDDING AND BACKFILL

A. Storm and Sanitary Sewer Trenches:
1. The cement-stabilized sand bedding shall not extend from a point 6 inches below the bottom of the pipe to the level of the spring line. This material shall not be used after it loses its moisture content.
2. The cement-stabilized sand shall be thoroughly rodded after being placed in the trench.
3. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill shall be placed to one foot above

the top of pipe for earth backfill and 6 inches over the top of pipe for cement-stabilized sand backfill.

4. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
5. Backfill shall be placed in uniform layers not to exceed 8 inches loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D698).
6. Backfill, under pavement and to one foot from outer edge, shall b e cement-stabilized sand, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 5 above and stabilized where required.

B. Water Line Trenches:
1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95 percent Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8 inch loose depth. Each lift shall be compacted to a minimum of 90 percent of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.

C. Natural Gas Trenches:
1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
2. Natural gas lines shall not be installed in trenches with other utilities.

D. Utility Locators:
1. Provide metallic locator over all underground utilities, including irrigation piping, plumbing, control wiring, conduit, data, etc. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION

SECTION 22 05 17
PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock & cylinder lock for Owner selection

E. Prime coat finish

F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer’s printed instructions.

C. Minimum size required:
1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items in ceilings
2. 8 inch x 8 inch for plumbing for single isolation valve or shock arrestor

END OF SECTION

SECTION 22 05 23
VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing Valves

B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.

B. Butterfly Valves
1. Butterfly valves shall conform to MSS-SP67.
2. Liners, inserts and discs shall be suitable for the intended service.
3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
4. All valves for domestic use must be lead free.

C. Ball Valves
1. Provide ball valves with:
   a. Blowout proof stem.
   b. Full size port, 316 stainless steel ball and stem.
   c. Cast bronze body.
   d. Threaded ends.
2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
3. Service rating:
   a. 150 psi saturated steam.
   b. 600 psi WOG.
4. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
5. All valves for domestic use must be lead free.

D. Valve Connections
1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
2. Thread pipe sizes 2 inches and smaller.
3. Flange pipe sizes 2-1/2 inches and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use press valves when using copper press systems.

E. Valve Operators
1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
2. When cocks and valves are furnished with square head stem:

a. Provide one wrench for every ten cocks or valves sized 2 inches and smaller, minimum of two.
b. Provide each cock or valve size 2-1/2 inches and larger with a wrench with setscrew.

3. Where butterfly valves are provided:
   a. Provide gear operators on valves 6 inches and larger.
   b. Where valves are located 7 feet or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5 feet above floor and hook to clips, arrange to clear walking space.
   c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4 inches and smaller.

F. Acceptable Manufacturers (All listed must be lead free):
1. Nibco
2. Viega
3. Keystone

G. Check Valves
1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
3. Acceptable Manufacturers (All listed must be lead free):
   a. Watts
   b. Nibco

H. Backflow Preventer (All valves for domestic use must be lead free):
1. 2 inches and smaller, bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain.
2. 2-1/2 inches and larger, stainless steel or FDA epoxy coated ductile iron reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain.

I. Provide valves of same manufacturer throughout where possible.

J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

L. Provide valve, seat and trim materials suitable for the intended service.

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. Bronze "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2 inch size and smaller with screw connections rated 400 psi WOG.
2. Over 2 inch size with flanged connections, rated 125 psi WOG.

C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2 inches.
2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
3. With 0.125 perforations in piping systems 4 inches and larger.

D. Start-up:
1. Provide an additional fine mesh disposable screen for use during start-up operations.
2. Remove after 30 days.
3. Attach to piping for Owner's review.

E. Acceptable Manufacturers (All listed must be lead free):
1. Nibco
2. Watts

2.3 VALVE SCHEDULE

A. Domestic Service
1. Cold and Hot water service (all listed must be Lead Free):
a. Nibco Ball Valve full port through 2 inch: T-585-66-LF
b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF
c. Nibco Butterfly Valve 2-1/2 inch and larger: LD-2000 EDPM Gaskets
2. Check Valve (All listed must be Lead Free):
a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats)
b. Nibco Check Valve 2-1/2 inch and larger: F - 918 – Y -LF (Buna-N disc.)
c. Nibco Check Valve 2-1/2 inch and larger: W - 920 -W-LF (Wafer)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.

C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.

D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
1. 1 inch valve for pipes 6 inch and larger.
2. 3/4 inch valve for pipes smaller than 6 inch.
3. Terminate with pipe plug.
4. Drain valves shall be ball valves.

E. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.

F. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will

not damage the insulation.

G. Provide clearance for installation of insulation and access to valves.

H. Provide access where valves are not exposed.

3.2 VALVE TAGS

A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment being served and the service is obvious.

B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
   1. A specialist in this field and have the personnel, experience, training, 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.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:
1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL
3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
2. Cell-U-Foam

C. Aluminum Jacketing:
1. Childers
2. Pabco
3. RPR

D. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4. Vimasco

E. Mastics and Adhesives
1. Childers
2. Foster
3. Vimasco
4. Armstrong 520 Adhesive

F. Elastomeric Insulation
1. Armacell

G. Weather Resistant Coating
1. WB Armaflex Finish

H. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
2. Owens-Corning eD75 or ED100 RKF
3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾” shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In

addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.4 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb./cu.ft. (128 kg/cu.m.) density

2.5 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
   1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
   2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 adhesive.

B. Vapor Barrier Finish:
   1. Indoors: Provide as insulation coating Childers CP-35, white.
   2. Outdoors: Provide as insulation coating Childers Encacel X.
   3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.

C. Sealant. Provide Childers CP-76 vapor barrier sealant.

D. Lagging Adhesive. Provide Childers CP-50.

E. Other products of equal quality will be acceptable only upon approval.

2.7 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.

C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and

covers according to manufacturer's recommendations.

2.8 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.

B. Install hanger with protective shield, on the outside of all insulation.

C. Where domestic water pipes (1/2” & ¾” pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4” pipe and 16-gauge for 5” pipe and above.

E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.

G. Piping to be insulated as specified above:
1. All hot and cold water.
2. Make-up water
3. Horizontal sanitary drain piping that receives condensate
4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down
5. Wall hydrant entire box, valve and piping in exterior walls.

3.2 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.

C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½” wide glass filament tape.

D. Apply a tack coat of fitting mastic over the insulation and tape.

E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.

F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
3. Overlap mastic and fiberglass cloth by 2” on adjoining sections of pipe insulation.
4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
5. Apply mastic to a wet film thickness of 3/64”.
6. Fabric shall not be visible after completion.
7. Vapor seal flanges, valves and fittings with Childers CP-35.

B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3” to make a weather tight seal.

C. Install straps on 9” centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.

B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2” with facing to the outside to obtain specified R-value using

a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3” wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3” (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6” (152mm) on center.

D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

A. Install materials after piping has been tested and approved.

B. Apply insulation on clean, dry surfaces only.

C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2” Pipe and Smaller	1
Domestic Hot Water Piping, 2” Pipe and Larger	1-1/2

END OF SECTION

SECTION 22 08 00
PLUMBING COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 22 Plumbing.

B. Related Sections:
1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

A. The Owner will contract directly for commissioning services.
1. Commissioning Agent fee will be paid for directly by the owner.
2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing is listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0ºF and a resolution of + or - 0.2ºF). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and

system installation work required by the Division 22, 23 and 26 specifications including specific contractor furnished items indicated by this Section shall be provided by the Contractor.

3.2 SUBMITTALS

A. Plumbing
1. Plumbing Equipment.

3.3 EQUIPMENT START-UP

A. Notification
1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design Team of start-up dates.

B. Prior to start-up, contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected to utilities and ready for operation. Perform all pre-start inspections and tests as called for in Division 22.
2. Comply with pre-start requirements of manufacturer and complete applicable documentation.
3. Complete applicable sections of Pre-functional Checklists.
4. Coordinate start-up attendance by manufacturer or authorized representative as required by specifications or manufacturer.

C. At start-up, contractor shall:
1. Supervise the activities of the authorized start-up technician or manufacturer's representative.
2. Verify proper voltage, phase, drive rotation and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action.

3.4 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. As an alternate, contractor shall submit their versions of the PFC's to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:
1. Plumbing:
a. Domestic Hot Water Heater/Converter
b. Recirculation Pump
c. Mixing Valve

3.5 FUNCTIONAL TESTING

A. General
1. Contractor shall organize and schedule Construction Team members to execute the functional testing, which will be directed by CxA.

B. Recirculation Pump
   1. Graphics
   2. Start/Stop/Schedule
   3. Pump Operation (On/Off/Hand/Auto)
   4. Temperature Sensor Calibration

C. Domestic Water Heater
   1. Graphics
   2. Start/Stop Schedule
   3. Discharge Temperature

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Valves, Strainers and Vents
2. Pipe and Pipe Fittings - General
3. Plumbing Piping Insulation
4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Below Slab on Grade Piping for Water Entries:
1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a “bending” temper tubing.
3. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.

B. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.

C. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.

D. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.

E. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and

hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.

B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.

C. All water hammer arrestors shall be installed in a vertical position.

D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

2.3 Domestic Manufacture

A. All piping material, pipe and fittings, shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 DRAINAGE

A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

A. Sterilize the water system with solution containing not less than 50PPM available chlorine. Allow chlorinating solution to remain in system for period of 8 hours (minimum). Have valves and faucets opened and closed several times during the period. After sterilization, flush the solution from the system with clean water until residual chlorine content is less than 0.2 parts per million.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.4 TESTING

A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.

C. Use only potable water for the test.

D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.

E. If the system is tested in sections, the entire domestic water piping system shall be submitted

to a final test, employing the specified procedure.

F. Do not insulate or conceal piping systems until tests are satisfactorily complete.

G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

A. Corrosion protect copper tube piping systems:
1. In the building slab.
2. Beneath the building slab.
3. Buried.
4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.

B. Cover copper tubing piping system with:
1. "Tapecoat" TC Primer.
2. "Tapecoat" CT cold applied coating tape.

C. Install coating system as specified by the manufacturer.

D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).

B. Make repairs to small holes in accordance with the manufacturer's instructions.

C. Retest the repairs using procedures listed above.

D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION

SECTION 22 13 16
SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

A. Site Work:
   1. Sanitary Sewers
   2. Excavation, Trenching and Backfilling for Utilities

B. Division 22 Plumbing:
   1. Pipe and Pipe Fittings
   2. Plumbing Fixtures and Fixture Carriers
   3. Drains, Cleanouts and Hydrants
   4. Earthwork

1.3 REFERENCES

A. CISPI - Cast Iron Soil Pipe Institute

B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All No-Hub clamps must have 4 bands minimum. Sizes 5” through 10” shall have six bands minimum.
   1. No-Hub Clamps – Sanitary Waste:
      a. Husky SD 4000
      b. Clamp- All Hi Torq 125
   2. No-Hub Clamps - Vents
      a. Husky SD – 2000
      b. Mission Rubber Co., LLC Heavy Weight Couplings
      c. Clamp-All Hi-TorQ 80

B. Provide “Husky” shielded couplings Series 4200 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2” through 8” Series 4200.

C. Cast Iron Soil Pipe and Fittings:
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

A. Above Slab Pipe:
   1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.

2. Pipe shall conform to ASTM A74.
3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute

B. Below Slab on Grade Piping:
1. Schedule 40 PVC plastic pipe and DWV fittings.
2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.

2.3 VENT PIPE AND FITTINGS

A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
2. Pipe shall conform to ASTM A74.
3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564

B. Below Slab on Grade Piping:
1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.

C. Above Slab Pipe.
1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations and equipment charge.

2.4 DOMESTIC MANUFACTURE

A. All piping material, pipe and fittings, shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer’s recommendations and applicable standards.

D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed

outside the building slab.

E. All PVC underground shall be installed in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal pipe grade of ¼-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.3 DRAIN PIPE AND FITTINGS

A. Offsets and Fittings.
1. Use reduction fittings to connect two pipes of different diameter.
2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eights-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.

B. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.

C. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.4 VENT PIPING

A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.

B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.

C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

3.5 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.6 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All sanitary soil and waste lines below building 3” and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner’s Representative shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner’s Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.7 SMOKE TESTING

A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing on all interior sanitary sewer piping and sanitary vent piping above and below floor prior to cover-up..
2. Artificially created smoke used must be a persistent white tracer smoke and

produced by thermogenic chemical reaction. All smoke candles or smoke pencils to be used must be non-toxic and EPA approved. Provided by Superior Signal Smoke Candles.

3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
6. Typical findings from indoor smoke testing may include:
    a. Dry traps in floor drains
    b. Improperly capped sewer lines or vents
    c. Broken sewer lines or vents
    d. Cross connected sewer vents and drains
    e. The drawing of air emanating from sewer vents into intakes of air exchange systems
    f. Poorly glued pipe joints
    g. Loose no-hub couplings
7. An Owner’s Representative shall be present during smoke testing.

END OF SECTION

SECTION 22 14 13
ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Pipe and Pipe Fittings - General; for general piping requirements.
   2. Drains and Cleanouts.
   3. Plumbing Piping Insulation.
   4. Earthwork

1.3 REFERENCES

A. CISPI – Cast Iron Soil Pipe Institute

B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cast Iron Soil Pipe and Fittings
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.2 STORM PIPE AND FITTINGS

A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.

C. Provide “Husky” shielded couplings, Series 4200 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2” through 8” use Series 4200.

2.3 DOMESTIC MANUFACTURE

A. All piping material, pipe and fittings, shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab storm piping installation methods shall be in accordance with

the Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer’s recommendations and applicable standards, and in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.4 RODDING SEWERS

A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All storm lines below building 3” and larger shall be internally video-taped at time of substantial completion. An Owner’s Representative shall be present during video-taping. Three copies of the video-tape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner’s Representative, as part of the Contract, to ensure 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 for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION

SECTION 22 20 00
PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Earthwork
   2. Valves, Strainers and Vents
   3. Insulation
   4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
   1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
   1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
   2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.

3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
2. 6" through 10" pipe size coupling housing minimum of 4" width.
3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.

G. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.

H. Ring-Tite Joints: Ring-Tite gasketed sewer fittings for sanitary and storm. Furnish joints for installation manufactured per ASTM/CSA, Ipex, and J.M Eagle C900. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.

I. Press fittings for copper pipe 1/2” to 4”: Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such

as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

E. Press Connections: Copper and steel press fittings ½” through 4” shall be applied in accordance with the manufacturer’s installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-“Pro-Press”.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if

used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion.

F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.

D. Connect dead-end supply and return headers, even if not shown on the drawings, and

provide terminal drains in bottom of pipe end caps or blind flanges.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.

G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.

H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. Both sides of penetrations through walls, floors and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 22 33 13
TANKLESS ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Tankless electric water heaters for domestic water systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Domestic Water Piping.
   2. Plumbing Piping Insulation.
   3. Division 26 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chronomite

B. EEMAX

C. Stiebel Eltron

2.2 PRODUCTS

A. Provide tankless, flow switch activated heater.

B. Hot water temperature range of 103°F to 120°F.

C. 0.5 GPM flow rate.

D. Low pressure model if required. Contractor shall verify pressure at site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install where shown on Drawings and in accordance with manufacturer's requirements.

3.2 WARRANTY

A. Provide standard manufacturer’s 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION

SECTION 22 33 33
ELECTRIC WATER HEATER (Commercial ASME)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Domestic Water Piping.
   2. Plumbing Piping Insulation.
   3. Division 26 Electrical.

1.3 WARRANTY

A. Provide standard manufacturer’s 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bradford White

B. State.

C. A. O. Smith

2.2 PRODUCTS

A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.

B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.

C. Furnish factory-assembled, integral units equipped as follows:
   1. Immersion thermostat.
   2. High temperature limit switch (energy cutout).
   3. Low-water cutoff.
   4. Heavy duty UL rated for 100,000 cycles.
   5. Temperature and pressure relief valve.
   6. Anode rod.

D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.

E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installations shall be in accordance with the manufacturer's published recommendations.

C. Furnish all supports required by the equipment included in this Contract.

D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.

E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
   1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
   2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.

F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

G. Route condensate to a vented receiver.

H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.

I. Set the operating and safety controls.

J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.

K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.

L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Drains, Hydrants and Cleanouts.
   2. Domestic Water Piping.
   3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Plumbing Fixtures (Vitreous China):
   1. American Standard.
   2. Crane
   3. Eljer

B. Plumbing Faucets:
   1. Chicago.
   2. T&S Brass

C. Supports and Carriers:
   1. Zurn
   2. J.R. Smith.
   3. Josam.
   4. MIFAB

D. Flush Valves:
   1. Sloan Royal

E. Supplies, Stops and Chrome Plated Tubular Brass:
   1. McGuire
   2. Chicago
   3. Zurn

F. Water Closet Seats (White):
   1. Beneke
   2. Bemis

G. Electric Drinking Fountains:

1. Halsey Taylor
2. Elkay
3. Murdock

H. Floor Drains:
1. J.R. Smith
2. Josam
3. Zurn
4. MIFAB

I. Cleanouts:
1. J.R. Smith
2. Josam
3. Zurn
4. MIFAB

J. Stainless Steel Sinks:
1. Elkay
2. Just
3. Franke

K. Roof Drains:
1. J.R. Smith
2. Josam
3. Zurn
4. MIFAB

L. Thermostatic Mixing Valves
1. Chicago
2. Symmons
3. Leonard
4. Powers

M. Shock Arrestors:
1. Precision Products
2. Sioux Chief

N. Hose Bibbs
1. T&S Brass
2. Chicago

O. Wall Hydrants
1. Wade
2. Zurn
3. Josam
4. Acorn

P. Trap Primers
1. Precision Plumbing Products

2.2 REQUIREMENTS

A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions.

B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.

C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.

D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.

E. Remove piping and services roughed-in incorrectly and install correctly, without cost.

F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.

G. Coordinate with the Contractor for locations and service required for each plumbing fixture.

H. All floor drains, and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.

I. All floor drains, and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.

J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal resistant screws.

K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION

SECTION 23 01 00
HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Schedule of filters for each item of equipment.
11. Schedule of belts for each item of equipment.
12. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Electronic copies of complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1".
Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
a. Size: 8-1/2" x 11".
b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
a. Provide reinforced punched binder tab and bind in text.
b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
a. Title of Project
b. Identity of separate structures as applicable.
c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
a. Contractor, name of responsible principal, address and telephone number.
b. A list of each product required to be included, indexed to content of the volume.
c. List with each product, name, address and telephone number of:
1) Subcontractor or installer.
2) Maintenance contractor as appropriate.
3) Identify area of responsibility of each.
4) Local source of supply for parts and replacement.
d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
a. Include those sheets pertinent to the specific product.
b. Annotate each sheet to:
1) Identify specific product or part installed.
2) Identify data applicable to installation.
3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
a. Supplement product data with drawings as necessary to illustrate:
1) Relations of component parts of equipment and systems.

2) Control and flow diagrams.
b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:
a. Organize in consistent format under separate headings for different procedures.
b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
a. Provide information sheet for Owner's personnel, giving:
1) Proper procedures in event of failure.
2) Instances that might affect validity of warranties or bonds.
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
a. Description of unit and component parts.
1) Function, normal operating characteristics, and limiting conditions.
2) Performance curves, engineering data and tests.
3) Complete nomenclature and commercial number of replaceable parts.
b. Operating procedures:
1) Start up, break-in, routine and normal operating instructions.
2) Regulation, control, stopping, shut down and emergency instructions.
3) Summer and winter operating instructions.
4) Special operating instructions.
c. Maintenance procedures:
1) Routine operations
2) Guide to trouble-shooting.
3) Disassembly, repair and reassembly.
4) Alignment, adjusting and checking.
5) Routine service based on operating hours.
d. Servicing and lubrication schedule. List of lubricants required.
e. Manufacturer's printed operating and maintenance instructions.
f. Description of sequence of operation by control manufacturer.
g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
1) Predicted life of part subject to wear.
2) Items recommended to be stocked as spare parts.
h. As installed control diagrams by controls manufacturer.
i. Complete equipment internal wiring diagrams.
j. Schedule of filters for each air handling system.
k. Schedule of belts for each item of equipment.
l. Each Contractor's coordination drawings.
m. As installed color coded piping diagrams.
n. Charts of valve tag number, with location and function of each valve.
o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
p. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 23.

5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide extended compressor warranty certificates.

END OF SECTION

SECTION 23 05 00
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.

B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Mechanical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 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, skill, and 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 has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of

various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
6. Indicate exact location of all underground mechanical piping and elevation.
7. Indicate exact location of all underground electrical raceways and elevations.
8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads.

Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.

B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.

C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 20 hours dedicated instructor time.
   2. 5 hours on each of 4 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.6 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.7 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.9 INDOOR AIR QUALITY

A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.

B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.

C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.

D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.

E. Utilize manufacturer’s recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.

F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.

G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.

H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 05 10
HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK-UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock-up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
   1. Rough-in.
   2. Finish with all appurtenances in place.
   3. Insulation installed.
   4. Demonstrations.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 FAN/COIL UNITS (WATER SOURCE HEAT PUMPS)

A. Mock-up a fan/coil unit (water source heat pump) completely installed, including:
   1. Primary, secondary and auxiliary drain pans.
   2. Piping connections; including all piping appurtenances.
   3. Pipe insulation.
   4. Condensate drain piping.
   5. Electrical connections.
   6. Duct connection beyond first transition.
   7. Block valves, balancing valves, and control valves.
   8. Cabinet/internal vibration isolation.
   9. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
   1. Filter accessibility.
   2. Accessibility to drain and components for service.
   3. Controls sequence.

3.2 AIR HANDLING UNIT

A. Mock-up an air handling unit, completely installed, including:
   1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
   2. Pipe insulation.
   3. Condensate drain piping.
   4. Electrical connections.
   5. Ductwork beyond the first transition.
   6. Control valves and bypass.

7. Cabinet/internal vibration isolation.
8. Block valves and balancing valves.
9. Duct insulation.
10. Instrumentation.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
1. Filter accessibility.
2. Accessibility to drain and components for service.
3. Controls sequence.

3.3 CONSTANT VOLUME TERMINAL BOX

A. Mock-up a Constant Volume Terminal Box completely installed, including:
1. Piping connections, including all piping appurtenances.
2. Pipe insulation.
3. Electrical connections.
4. Duct connection beyond first transition.
5. Block valves, balancing valves, and control valves.
6. Cabinet/internal vibration isolation.
7. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
1. Control Sequence.
2. Accessibility to components for service.

3.4 HOT AND CHILLED WATER CIRCULATING PUMPS

A. Mock-up one each system pump, completely installed including:
1. Pump mounted on housekeeping pad.
2. Auxiliary drain pan. (Chilled water only)
3. Piping to a point beyond the complete valve and instrumentation assemblies.
4. Strainers with blowdown.
5. Flexible piping connection.
6. Pipe supports.
7. Pipe insulation.
8. Pump painting.
9. Electrical connections.

3.5 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 23 05 11
MECHANICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor’s responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify actual HVAC supply and return piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.

D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner’s review and salvaged by Contractor.

F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.

C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.

D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by

remodeled construction.

E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.

F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.

G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.

H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.

I. Remove concrete housekeeping pad where materials or equipment have been removed.

J. Remove all known utilities, which do not provide service to the buildings that remain.

K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.

D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.

H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

3.7 REFRIGERANT DISPOSAL

A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes.

END OF SECTION

SECTION 23 05 12
HVAC SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by these specifications as outlined below.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings
2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name, address and contact number.
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.

2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 23 05 13
ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for mechanical equipment.
2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
8. Pipe heat tracing.
9. Cooling tower vibration switch/interlock/reset.
10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
12. Wiring of all related circulating water system chemical treatment devices.
    a. Low voltage electric contacting water meter
    b. Solenoid valve/blow-down assembly
13. Radiant heater timer switches and/or thermostats
14. Low Voltage thermostat wiring

C. Refer to Division 23 Controls Sections for related control system wiring.

D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.

E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.

F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for mechanical equipment manufactured by one of the following:
1. Baldor Electric Company.
2. Century Electric Div., Inc.
3. General Electric Co.
4. Louis Allis Div.; Litton Industrial Products, Inc.
5. Lincoln Electric
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.
9. WEG

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:

C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual

section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.

3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

2.2 EQUIPMENT FABRICATION

A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR’s Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.

B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer’s instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 23 05 14
HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

A. Division 23 - Mechanical
   1. Insulation
   2. Packaged DX Air Conditioners

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

A. Type “L” copper with drainage pattern fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the system to facilitate easy removal.
   1. Use threaded plugged tee at each change of direction to permit cleaning.
   2. Install a cleanout every 50 feet of straight run piping
   3. Maintain a positive slope on all piping

B. Install a water seal trap leg based on the fan pressure.
   1. Size the length of the trap leg 1 inch larger than the actual system pressure.

C. Install traps and cleanout as shown in the drawing details.
   1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION

SECTION 23 05 17
HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock & cylinder lock for Owner selection

E. Automatic closing and latching mechanism

F. Prime coat finish

G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer's printed instructions.

C. Minimum size required:
1. 36" x 24" for Mechanical HVAC equipment related items
2. 18" x 18" for electrical related items

END OF SECTION

SECTION 23 05 48
VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SCOPE

A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
   2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Amber Booth
B. Kinetics
C. Mason
D. Korfund
E. VSI.
F. Vibration Eliminator Co., Inc.
G. Metraflex

2.2 ISOLATOR TYPES

A. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

B. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
In-Line Fans	A	0.5”

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Condensing Units	B	0.35”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.

B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 05 93
TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Balance, adjust and test the air distribution system including the exhaust system.

B. Balance, adjust and test the hydronic system.

C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

A. History of the TAB organization.

B. Agency certification.

C. Personnel qualifications.

D. TAB data forms.

E. Instrumentation list.

F. Name of the project supervising engineer.

G. Name and address and contact person of five successfully completed projects of similar size and scope.

H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.

B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.

C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.

D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing

agency's performance capability.

E. The balancing agency shall have operated for a minimum of five years under its current name.

F. Personnel:
1. The project supervisor shall be a Professional Engineer registered in Texas.
   a. Extensive knowledge of the work involved.
   b. At least five years experience conducting tests of the type specified.
   c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
2. All work shall be conducted under the direct supervision of the supervising engineer.
3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

A. Provide (AABC) guarantee in writing.

B. Extended warranty.
1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.

B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.

C. Note proper piping installation, location of valves, and flow measuring instruments.

D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.

E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.3 TESTING INSTRUMENTS

A. Submit a list of all instruments to be used for the test and balance procedures.
1. Catalog sheets
2. Certificate of last calibration
3. Calibration within a period of six months prior to balancing

B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.

B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.

C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
2. Verify that all control devices are properly connected.
3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
7. Observe the calibration of all controllers.
8. Verify the proper application of all normally opened and normally closed valves.
9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous

heating and cooling occurs.

12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
13. Check all dampers for free operation.
14. Verify that all controller setpoints meet the design intent.
15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.5 INSTRUMENT TEST HOLES

A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
   1. Drill holes, plug and tape external duct insulation.
   2. Repair damaged insulation to Engineer’s approval.

3.6 TESTING THE AIR DISTRIBUTION SYSTEM

A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
   1. Supply Fans:
      a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
      b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
      c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
      d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
      e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
   2. All Other Fans:
      a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
      b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
      c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear

on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.

d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.

3. VAV Terminal Units:
   a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
   b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
4. Diffusers, Registers and Grilles:
   a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
5. Coils (including electric coils):
   a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.

B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.

C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.

D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.

E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.

F. Measure and adjust all supply and return branches to design air delivery.

G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.

H. Make a set of recordings showing final system conditions.

3.7 TESTING THE HYDRONIC SYSTEMS

A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Record preliminary pump data.
   a. Pump RPM.
   b. Pump shut-off differential head.
   c. Pump operating differential head.
   d. Check and verify pump alignment.
   e. Verify impeller diameter.

B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.

C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.

D. Balance flow through:
1. Chillers.
2. Coils.
3. Boiler.
4. Pumps
5. Condensers.
6. Cooling tower.
7. Heat Exchanger.

E. Use flow meters, differential pressures and temperature relationships as required.

F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.

G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.

H. Pumps:
1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation Record appropriate gauge readings for final TDH and Block-Off\Dead head calculations. Check and verify pump alignment.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

I. Coils:
1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.

J. Boilers:
1. Verify that boilers have been filled and started by others, and are in operation.
2. Current and Voltage: As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
3. Test, adjust and record water flows through water boilers.
4. Test and record water temperature profiles of each boiler.

K. Chillers:
1. Verify that chillers have been started by the manufacture and are in operation. Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
3. Test and record temperature profiles of each chiller at design water flow.

L. Cooling towers:
1. Verify that cooling towers have been filled and started by others and are in operation.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure cooling tower fan motor is not in or above the service factor.
3. Test and adjust water flows to balance tower cells and flows between towers.
4. Test and record water temperature profiles of each condenser at design water flow for water and air side operation.

M. Heat exchangers:
1. Verify that heat exchangers have been filled and started by others, and are in operation.
2. Test and record temperature and pressure profiles of water and steam heat exchangers.

3.8 EQUIPMENT POWER READINGS

A. Record the following information for each motor:
1. Equipment designation.
2. Manufacturer.
3. Unit model number and serial number and frame.
4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
5. Heater coil in starter.
a. Rating in amperes.
b. Manufacturer's recommendation.
6. Motor RPM/driven equipment RPM.
7. Power reading (voltage, amperes of all legs at motor terminals).

3.9 BOILERS

A. Check for proper operation and with operation at near design conditions, record the following:
1. Manufacturer, model number, serial number and nameplate.
2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
3. Type of fuel and heating value.
4. Rate of fuel consumption.
5. Capacity in MBH.
6. Efficiency.
7. Flue gas analysis.
8. Motor data.

B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

3.10 CHILLERS (Water Cooled)

A. Balance flow of water thru each evaporator and condenser to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.

B. Verification of safety interlocks and controls are the responsibility of the manufacturer.

C. With each chiller operating at near design temperature and water flow conditions, measure and record the following:
   1. Manufacturer, model number, serial number and all nameplate data.
   2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
   3. Condenser water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
   4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
   5. Volts and amps for each phase.
   6. Power factor.
   7. KW input.
   8. Tons of cooling.
   9. KW per ton of cooling.

D. Reference chiller specification for additional requirements.

3.10 CHILLERS (Air Cooled)

A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.

B. Verification of safety interlocks and controls are the responsibility of the manufacturer.

C. With each chiller operating at near design temperature conditions, measure and record the following:
   1. Manufacturer, model number, serial number and all nameplate data.
   2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
   3. Condenser air entering temperature, leaving temperature.
   4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
   5. Volts and amps for each phase.
   6. Power factor.
   7. KW input.
   8. Tons of cooling.
   9. KW per ton of cooling.

D. Reference chiller specification for additional requirements.

3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM

A. All VAV boxes used are to be calibrated to produce the rated air quantity.

B. Set and record the supply air static pressure controller to provide actual design air flow at the most resistive terminal.

C. Measure and adjust the design air delivery at the inlet of each VAV box.

D. Measure and record the air quantity from each VAV box at its maximum flow. Manipulate the controller to achieve maximum flow.

E. Reset each box to yield and record minimum primary air flow.
   1. DDC controllers record the correction factor required to establish actual desired air quantity as designed.

2. Pneumatic controllers adjust velocity controller as required to establish actual desired air quantity as designed.

F. If the box is operating with inlet static pressure in excess of the minimum cataloged pressure specified by the manufacturer and is not producing rated air quantity, field adjust the box to produce rated air quantity. Retest until approved results are obtained.

G. Position the VAV boxes to the proportion of maximum fan air volume to total installed box maximum volume.

H. Set the fan to deliver the AHUs scheduled design airflow.

I. Perform and record a total air traverse.

J. With the system terminal boxes set for full flow or diversity, the system will be delivering the scheduled design CFM with the most restrictive box in control. Make a speed increase if either or both static and volume are low.

K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent excessive static in the system.

L. Coordinate with the work specified in Building Management and Control System on the final location of the sensors for the static pressure controller. Locate in the supply duct far enough from the fan discharge to be truly representative of the average static pressure in the system.

M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static pressure sensing network.

N. Make a set of recordings showing final system conditions including system duct static pressures and control system setpoint.

3.12 DUCT TEST

A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.13 DIRECT EXPANSION EQUIPMENT

A. With each unit operating at near design conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
2. Ambient temperature, condenser discharge temperature.
3. Amperage and voltage for each phase.
4. Leaving and entering air temperatures.
5. Suction and discharge pressures and temperatures.
6. Tons of cooling.
7. Verification that moisture indicator shows dry refrigerant.

3.14 COOLING TOWERS

A. A complete CTI certified test of the cooling tower will be performed by others at the expense of the cooling tower manufacturer. A copy of this test (provided by others) shall be included in the final TAB Report. Balance the flow over and through bypass connections of the tower.

3.15 TAB REPORT

A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.

B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.

C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
1. Title Page
    a. Company Name
    b. Company Address
    c. Company telephone number
    d. Project name
    e. Project location
    f. Project Manager
    g. Project Engineer
    h. Project Contractor
    I. Project Identification Number
2. Summary of the TAB report data
3. Index
4. Instrument List
    a. Instrument
    b. Manufacturer
    c. Model
    d. Serial Number
    e. Range
    f. Calibration Date
    g. What test instrument is to be used for:
5. Fan Data
    a. Location
    b. Manufacturer
    c. Model
    d. Air flow, specified and actual
    e. Total static pressure (total external) specified and actual
    f. Inlet pressure
    g. Discharge pressure
    h. Fan RPM
6. Return Air/Outside Air Data
    a. Identification/location
    b. Design return air flow
    c. Actual return air flow
    d. Design outside air flow
    e. Actual outside air flow
    f. Return air temperature
    g. Outside air temperature
    h. Required mixed air temperature

I. Actual mixed air temperature

7. Electric Motors
   a. Manufacturer
   b. HP/BHP
   c. Phase, voltage, amperage, nameplate, actual
   d. PM
   e. Service Factor
   f. Starter size, heater elements, rating
8. V-Belt Drive
   a. Identification/location
   b. Required driven RPM
   c. Drive sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave, diameter and RPM
   f. Center-to-center distance, maximum, minimum and actual
9. Duct Traverse
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   I. Air correction factor
10. Air Monitoring Station Data
   a. Identification/location
   b. System
   c. Size
   d. Area
   e. Design velocity
   f. Design air flow
   g. Test velocity
   h. Test air flow
11. Air Distribution Test Sheet
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Correction factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i. Test (final) air flow
12. Pump Data
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP
   g. Actual flow rate, pressure drop, BHP
   h. Discharge pressure
   I. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures

l. Shut off, total head pressure
m. Pressure differential settings

13. Cooling Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Entering air WB temperature, design and actual
    g. Leaving air DB temperature, design and actual
    h. Leaving air WB temperature, design and actual
    i. Water pressure flow, design and actual
    j. Water pressure drop, design and actual
    k. Entering water temperature, design and actual
    l. Leaving water temperature, design and actual
    m. Air pressure drop, design and actual
    n. Capacity - sensible and latent
14. Heating Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual
    g. Water pressure flow, design and actual
    h. Water pressure drop, design and actual
    i. Entering water temperature, design and actual
    j. Leaving water temperature, design and actual
    k. Air pressure drop, design and actual
    l. Capacity
15. Electric Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual
    g. Electrical Characteristics
    h. Capacity
16. Sound Level Report
    a. Location (Location established by the design engineer)
    b. N C curve for eight (8) bands-equipment off
    c. N C curve for eight (8) bands-equipment on
17. Vibration Test on equipment having 10 HP motors or greater in size.
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (if applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)
    b. Test readings:
        1) Horizontal, velocity and displacement

2) Vertical, velocity and displacement
3) Axial, velocity and displacement

c. Normally acceptable readings, velocity and acceleration
d. Unusual conditions at time of test
e. Vibration source (if non-complying)

18. Control verification indicating date performed and any abnormalities identified.
a. Point Location/Description
b. EMS Readout (Setpoint and Actual)
c. Actual Readout of all points
d. Interlocks
e. Safeties
f. Variable speed drive tracking with EMS input
g. Variable speed drive Bypass operation
h. Sequence of operation

END OF SECTION

SECTION 23 05 94
COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.

B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Bring the work to a state of readiness for testing, balancing, and adjusting.
1. Install air terminal devices.
2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
3. Verify lubrication of equipment.
4. Install permanent instrumentation.
5. Clean piping systems and fill with clean water.
6. Complete "Start-up" of equipment.
7. Check rotation and alignment of rotating equipment and tension of belted drives.
8. Verify ratings of overload heaters in motor starters.
9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
10. Provide control diagrams and sequence of operation.
11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
14. Comb out fins on extended-surface heat transfer coils where damaged.
15. Clean all strainers as required.
16. Remove construction strainers after water is cleaned and treated.
17. Remove all temporary filters from HVAC equipment.
18. Provide start-up reports listing all start-up information and manufacturer’s information attached.

B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.

C. Verify that the systems are ready for balancing and adjusting.

D. Submit a letter stating:
1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
2. Other equipment has been checked and started.
3. The systems have been operated for the specified period of time.
4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.

E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.

F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.

G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.

B. Complete start-up of equipment prior to start of testing & balancing.

C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM														
Equipment Description	*Actual*			*Disc. Switch Wired*	*Rotation Correct*	*Belt*		*RPM Correct Submittal*	*Vibration Isolation Correct*	*Attachment To Roof Curb*	*List Of Damage Parts*	*Bearings Lubricated*	*Filter Installed*	*Interlocks & Dampers Operational*
	Voltage	*Amps*	*HP*			*Condition & Part #*	*Tension Correct*							

SECTION 23 07 13
EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.

B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

A. Division 9 - FINISHES. Painting and Color Coding.

B. Division 23 - MECHANICAL.
1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
3. Insulation. Refer to specific sections on individual insulation types.
4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, 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.

C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated system is not approved.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.

B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

A. Glass fiber rigid duct insulation.
1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
2. Acceptable Manufacturers
a. Schuller 814 spin-glas FSK.
b. Owens-Corning Type 703 board RKF.
c. Knauf 3 PCF FSK.

B. Glass fiber blanket duct insulation.
1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
2. Acceptable Manufacturers
a. Manville R-series Microlite FSKL.
b. Owens-Corning ED100 RKF.
c. Knauf 1.0 PCF FSK.

C. Fiberglass reinforcing cloth mesh.
1. Acceptable Manufacturers
a. Perma Glass Mesh.
b. Alpha Glass Mesh.
c. Childers Chil-Glas #10
d. Foster Mast a Fab
e. Vimasco.

D. Mastics, sealants, coatings and adhesives.
1. Acceptable Manufacturers
a. Childers.
B. Foster.
c. Vimasco.

E. Fireboard Insulation
1. Totally encapsulated with foil facing.
2. Two hour rated fire protection.

3. Zero clearance to combustible protection.
4. System shall be listed and labeled by an NRTL.
5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
7. Acceptable Manufacturers
   a. Unifrax ON Fyrewrap Elite 1.5
   b. Partak Insulation, Inc. Paroc Fireboard
   c. Thermal Ceramics FireMaster 3M
   d. Premier Refractories International, Pyroscat.

F. Rigid Closed Cell Insulation
1. Acceptable Manufacturers
   a. Dow Trymer.
   b. Phenolic Foam.

G. Reinforced Foil Tape
1. Acceptable Manufacturers
   a. Venture 1525CW
   b. 3” FSK
2. Thickness 6.5 mils
3. Color: silver

2.2 COATING AND ADHESIVE

A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249.

C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.

D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

2.3 OUTDOOR DUCT LAMINATED JACKETING

A. Rubberized bitumen compound material:
1. Ultraviolet resistant
2. Weatherproof
3. Vapor retarding jacketing
4. Laminated jacketing
5. Cross-laminated high strength polyethylene film
6. Laminated to aluminum foil
7. Minimum 60-mil thickness

B. Acceptable Manufacturers:
1. Alumaguard 60
2. Flex Clad 400
3. Venture Clad 1577CW

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.

B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2” thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2”. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.

D. On circumferential joint, the 2” flange on the facing shall be stapled with 9/16” outward clinch steel staples on 2” centers, and taped with a minimum 3” wide strip of glass fabric embedded in coating. Cover all seams, joints, pin penetrations and other breaks with vapor barrier coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

E. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
1. Apply fabric and mastic to provide a smooth surface for painting.

B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.

D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.4 OUTDOOR DUCTWORK COVERING

A. Cover all supply and return ductwork outdoors:
1. 1-1/2” thick, rigid closed cell insulation with reinforced foil facing.

B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.

C. Impale the insulation over mechanical fasteners and washers.
   1. A minimum of 2 rows of fasteners per side on 12-inch centers.
   2. Seal all breaks, joints and punctures by applying a 1/8” thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.

D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4”.

E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
   1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4”.
   2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8”.
   3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
   4. Aluminum gray or white finish as approved by the Architect.

F. Standing water on horizontal surfaces is not approved.

G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

A. Secure fireboard insulation to duct with impaling pins and 3” square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12” centers.

3.6 GENERAL INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Apply insulation on clean, dry surfaces only.

C. Continue insulation with vapor barrier through penetrations.

D. Neatly finish insulation at supports, protrusions and interruptions.

E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.

F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.

G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, heating water, refrigerant lines, and condensate piping.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
   1. A specialist in this field and have the personnel, experience, training, 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.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

A. Finishes. Painting and color-coding

B. Pipe Heat Tracing

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:
1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL
3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
2. Cell-U-Foam

C. Rigid Foam Insulation:
1. Kingsapan Tarec
2. Dow Trymer
3. Tarec Ecophen – Phenolic Foam

D. Aluminum Jacketing:
1. ITW Lock-on (Childers)
2. ITW Z-lock (Pabco)

E. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4 Foster Mast a Fab
5. Vimasco

F. Mastics, Sealants, Coatings and Adhesives
1. Childers
2. Foster
3. Vimasco
4. Armacell 520 Adhesive

G. Elastomeric Insulation
1. Armacell

H. Weather Resistant Coating
1. WB Armaflex Finish
2 Foster 30-64

I. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
2. Owens-Corning eD75 or ED100 RKF
3. Knauf 0.75 PCF FSK

2.2 RIGID FOAM PIPE INSULATION

A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.

1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

2.3 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
   1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.4 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾” shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.
   1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.5 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.6 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1” beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½” aluminum bands (2) per shield.
   1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
   2. Minimum thickness of foam glass insulation shall not be less than 1” thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22”. Provide 18 gauge through 4” pipe and 16-gauge 5” pipe and above.

2.7 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.

B. Vapor Barrier Finish:
   1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white.

Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.

C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.

D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.

E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.

F. Other products of equal quality will be acceptable only upon approval.

2.8 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016” thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024” thick.

C. Straps and Seals. Provide ½” x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.9 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-38 or Foster 30-80 vapor barrier coating for chilled water piping applications.

B. Install hanger with protective shield, on the outside of all insulation.

C. Where domestic water pipes (1/2” & ¾” pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice

the insulation outside diameter. Provide 18-gauge through 4” pipe and 16-gauge for 5” pipe and above.

E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging adhesive Foster 30-35 or Childers CP-35 over all exposed insulation within mechanical rooms.

G. Piping to be insulated as specified above:
1. Chilled water and heating water
2. Make-up water
3. Horizontal sanitary drain piping that receives condensate
4. Condenser water

3.2 REFRIGERANT AND CONDENSATE PIPING

A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.

B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.

C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.

D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

E. Outdoor exposed piping after being sealed as noted above apply aluminum jacketing to protect piping insulation exposed to weather, from damage from sunlight, moisture, equipment maintenance, wind, and shall provide shielding from solar radiation. Adhesive Tape shall not be permitted.

3.3 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.

C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½” wide glass filament tape.

D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.

E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.

F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after

completion.

G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.4 UNDERGROUND PIPE COVERING

A. Cover chilled and hot water piping underground with cellular glass insulation.

B. Butter insulation joints with Childers CP-76 or Foster 95-50 vapor barrier sealant. Secure with stainless steel bands or ½” fiberglass reinforced tape on 9” centers.

C. Cover valves and flanges with fabricated fittings of thickness and material equal to the adjoining insulation. Fasten fittings in place with stainless steel bands or ½” fiberglass reinforced tape.

D. Apply a tack coat of fitting mastic Childers CP-22/24 or Foster 60-25/26 over the insulation and bands.

E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.

F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at all valves, fittings, flanges and every 21' on straight run piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe, making a complete seal.

H. Finish with 125 mil thickness Pittwrap jacket applied in accordance with manufacturer's instructions. At contractor's option, cover insulation with Servi-Wrap P-500 installed in accordance with manufacturer's instructions.

3.5 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
   1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
   2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
   3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2” on adjoining sections of pipe insulation.
   4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
   5. Apply coating/mastic to a wet film thickness of 3/64”.
   6. Fabric shall not be visible after completion.
   7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

B. PVC fitting covers are not acceptable.

3.6 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3” to make a weather tight seal with the application of 1/8” bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.

C. Install straps on 9” centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.7 MISCELLANEOUS

A. Insulate pumps.

B. Install materials after piping has been tested and approved.

C. Apply insulation on clean, dry surfaces only.

D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.8 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Refrigerant Piping	1-1/2
Condensate Drains	1

END OF SECTION

SECTION 23 08 00
MECHANICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 23 Mechanical.

B. Related Sections:
1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

A. The Owner will contract directly for commissioning services.
1. Commissioning Agent fee will be paid for directly by the owner.
2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing including, but not limited to equipment listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0ºF and a resolution of + or - 0.2ºF). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

C. Test equipment includes:
1. Air flow measuring devices (hoods, anemometers, etc.)
2. Water flow measuring devices
3. Temperature measuring devices (air and water)
4. Humidity sensors
5. Pressure gauges (air and water)
6. CO2 sensors

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT

A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 22, 23 and 26 specifications including specific contractor furnished items indicated by this Section shall be provided by the Contractor.

3.2 SUBMITTALS

A. Mechanical
1. Ductwork Layouts
2. Piping Layouts
3. Equipment Room Layouts
4. Mechanical Equipment as needed

3.3 EQUIPMENT START-UP

A. Notification
1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design Team of start-up dates.

B. Prior to start-up, contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected to utilities and ready for operation. Perform all pre-start inspections and tests as called for in Division 23.
2. Comply with pre-start requirements of manufacturer and complete applicable documentation.
3. Complete applicable sections of Prefunctional Checklists.
4. Coordinate start-up attendance by manufacturer or authorized representative as required by specifications or manufacturer.

C. At start-up, contractor shall:
1. Supervise the activities of the authorized start-up technician or manufacturer's representative.
2. Verify proper voltage, phase, overcurrent protection, drive rotation and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action.

3.4 PIPE AND DUCT PRESSURE/LEAKAGE TESTING

A. General
1. The following procedures are meant as general procedures and do not alleviate Contractor of more stringent procedures specified elsewhere in Division 23.

B. Notification
1. Contractor shall provide adequate notice to CxA, Owner and Design Team of testing dates.

C. Duct Pressure Testing:
1. Prior to testing, contractor shall:
a. Select duct sections with approval by Design Team.
b. Calculate duct areas and acceptable leakage rates.
c. Verify that test equipment is of appropriate capacity for duct sections tested. Ideally, the pressure testing equipment will be at the midpoint of the system tested.
d. Verify that test equipment has been calibrated with NIST traceable certificates within the past 12 months or shorter time span if specified elsewhere in Division 23.
e. Isolate and seal duct sections.
2. During testing, contractor shall:
a. Conduct testing in a safe manner.
b. Operate test equipment at a minimum of 3” wg for ductwork between AHU and terminal unit, or as specified elsewhere in Division 23.
c. Operate test equipment at a minimum of 2” wg for ductwork downstream of terminal units and exhaust ductwork, or as specified elsewhere in Division 23.
d. Record all applicable test data.
3. Upon completion of testing, contractor shall:
a. Remedy sections that do not pass and schedule a retest.
b. Submit test results to Owner, Design Team and CxA for review.

D. Pipe Pressure Testing
1. Prior to testing, contractor shall:
a. Verify that test equipment has been calibrated with NIST traceable certificates within the past 12 months or shorter time span if specified elsewhere in Division 23.
b. Isolate and seal pipe sections to be tested.
c. Isolate equipment or apparatus connected to the piping system that may be damaged during the testing.
d. Clean and flush piping sections and fill with clean water, venting all air.
e. Allow adequate time for water and piping to reach ambient temperature.
2. During testing:
a. Maintain a safe condition in the area surrounding the test system.
b. Pressurize piping to 150% of design working pressure, but not greater than piping design pressure.
c. Pipe shall hold pressure for minimum of 2 hours.
d. Record temperature of piping and ambient air at beginning and end of test.
e. Record pressure on piping system at beginning and end of test.
3. Upon completion of testing, contractor shall:
a. Remedy sections that do not pass and schedule a retest.
b. Submit test results to Owner, Design Team and CxA for review.

3.5 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFCs to the CxA for inclusion into the Cx documentation. PFCs will be provided by the CxA. As an alternate, contractor shall submit their versions of the PFCs to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:

1. Mechanical:
   a. Air Handling Units
   b. Energy Recovery Units
   c. Terminal Units
   d. Pumps
   e. Fans
   f. Heaters
   g. Split Systems
   h. Heat Exchanger/Converter
   i. Chiller
   j. Boiler
   k. Valves

3.6 TEST AND BALANCE

A. Contractor shall forward the T&B Execution Plan to the CxA prior to performing the field T&B activities. CxA will review and comment on Plan.

B. Contractor shall notify CxA a minimum of three (3) days prior to conducting field T&B activities. Failure to provide CxA with adequate notification may result in additional field time by T&B Contractor to demonstrate T&B results.

C. Key T&B activities that CxA requires notification on:
   1. Terminal Units.
   2. Air Handling Unit.
   3. Energy Recovery Unit.
   4. Heat Exchanger/Converter.
   5. Pumps.

3.7 FUNCTIONAL TESTING

A. General
   1. Contractor shall organize and schedule Construction Team members to execute the functional testing, which will be directed by CxA. Construction Team members may include Mechanical Sub, T&B Sub, Controls Sub, Electrical Sub, Fire Alarm Sub or Plumbing Sub. Contractor shall note that certain activities, such as sensor calibration, can be organized so that the T&B Sub is scheduled efficiently.

C. Air Cooled Chillers
   1. Graphics
   2. Start/Stop/Schedule
   3. Compressor Operation (On/Off/Hand/Auto)
   4. Entering/Leaving Temperature
   5. Safeties
   6. Alarms
   7. Temperature Reset Sequences

D. Boilers
   1. Graphics
   2. Start/Stop/Schedule
   3. Firing Operation (On/Off/Hand/Auto)
   4. Entering/Leaving Temperature
   5. Safeties
   6. Alarms
   7. Temperature Reset Sequences

E. Air Handling Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Damper Positions (Off/On/Safety)
6. Valve Positions (Off/On/Safety)
7. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
8. Alarms (Filter/Temperature/etc.)
9. Damper Operation (Normal/Economizer)
10. Valve Operation (Normal Heating & Cooling/Economizer)
11. Fan Speed Control (VFD)
12. Temperature Reset Sequences
13. Static Reset Sequences

F. Energy Recovery Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Air Flow Station Calibration
6. Damper Positions (Off/On/Safety)
7. Valve Positions (Off/On/Safety)
8. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
9. Alarms (Filter/Temperature/etc.)
10. Damper Operation (Normal/Economizer)
11. Valve Operation (Normal Heating & Cooling/Economizer)
12. Fan Speed Control (VFD)
13. Temperature Reset Sequences
14. Static Reset Sequences

G. Terminal Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Thermostat Operation
6. Damper Positions (Off/On/Safety)
7. Valve Positions (Off/On/Safety)
8. Safeties (Smoke Detectors/Fire Alarm)
9. Alarms (Temperature/etc.)
10. Unoccupied Overrides

H. Pumps
1. Graphics
2. Start/Stop/Schedule
3. Pump Operation (On/Off/Hand/Auto)
4. Flow Station Calibration
5. Pressure Sensor Calibration
6. Pump Speed Control (VFD)
7. Sequencing and Alarms

I. Fans
1. Graphics
2. Start/Stop/Schedule
3. Thermostat Operation

4. Flow Station Calibration
5. Pressure Sensor Calibration
6. Speed Control (VFD)
7. Sequencing and Alarms

J. Heaters
1. Graphics
2. Start/Stop/Schedule
3. Thermostat Operation
4. Flow Station Calibration
5. Sequencing and Alarms

K. Split Systems
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration
5. Thermostat Operation
6. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
7. Alarms (Filter/Temperature/etc.)
8. Fan Speed Control (VFD)

L. Recirculation Pump
1. Graphics
2. Start/Stop/Schedule
3. Pump Operation (On/Off/Hand/Auto)
4. Temperature Sensor Calibration

3.8 TREND DATA

A. Contractor shall enable trend data as indicated herein and as specified by contract documents and Owner's requirements. Trends shall be stored to a repository device that can be recalled at any time period. Sampling rate shall vary based upon the trend and may range from change of value (COV) to a maximum of 15 minutes.

B. Ambient (Outdoor) Conditions
1. Dry Bulb Temperature
2. Wet Bulb Temperature
3. CO2 Level

C. Building Loop Chilled Water System
1. Chilled Water Flow.
2. Chilled Water Supply Temperature.
3. Chilled Water Return Temperature.
4. Chilled Water Pressure Differential.
5. Chilled Water Pressure Setpoint.
6. Pump 1 Speed.
7. Pump 2 Speed.

D. Building Loop Hot Water System
1. Hot Water Flow.
2. Hot Water Supply Temperature.
3. Hot Water Return Temperature.
4. Hot Water Pressure Differential.
5. Hot Water Pressure Setpoint.
6. Pump 1 Speed.

7. Pump 2 Speed.

E. Air Handling Unit Supply Air
1. Supply Air Temperature.
2. Supply Air Temperature Setpoint.
3. Mixed Air Temperature.
4. Mixed Air Temperature Setpoint.
5. Chilled Water Valve Position.
6. Hot Water Valve Position.
7. Critical Terminal Unit Air Valve and Heating Position

F. Air Handling Unit Static Pressure
1. Duct Static Pressure.
2. Duct Static Pressure Setpoint.
3. Fan Speed
4. Critical Terminal Unit Air Valve Position

G. Air Handling Unit Economizer
1. Supply Air Temperature.
2. Supply Air Temperature Setpoint.
3. Mixed Air Temperature.
4. Mixed Air Temperature Setpoint.
5. Return Air Temperature.
6. Return Air Enthalpy.
7. Outside Air Temperature.
8. Outside Air Enthalpy.
9. Chilled Water Valve Position.
10. Hot Water Valve Position.
11. Return Damper Position
12. Relief Damper Position
13. Outside Air Damper Position

H. Terminal Units
1. Room Temperature.
2. Room Temperature Setpoint.
3. Supply Air Temperature.
4. Inlet Air Flow.
5. Inlet Air Valve Position.
6. Heating Coil Valve Position.
7. Fan Status.
8. Room CO2.

I. Split System Units
1. Room Temperature.
2. Room Temperature Setpoint.
3. Supply Air Temperature.
4. Fan Status.
5. Cooling/Heating Mode.

J. Fans
1. Room Temperature.
2. Room Temperature Setpoint.
3. Fan Status/Speed.

K. Heaters
1. Room Temperature.

2. Room Temperature Setpoint.
3. Status.

END OF SECTION

SECTION 23 20 00
HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

A. Division 23 Mechanical:
1. Earthwork.
2. Valves, Strainers and Vents.
3. Vibration Isolation.
4. Insulation.
5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment.

Otherwise, use raised-face flanges.

3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.

B. Provide supports both sides and within 12” of each horizontal elbow for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2” minimum vertical adjustment.

F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Provide hangers within 3' of pipe length from all coil connections.

I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure

that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.

B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.

D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.

G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.

H. Submit status reports upon completion of each phase of work on each system.

I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. both sides of penetrations through walls, floors and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Pipe and Pipe Fittings
   2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.

B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.

B. Use valves with a bronze body and sweat-type connections.

C. Provide stainless steel stem and plunger assembly and a stainless steel piston.

D. Furnish sealed and moisture proof solenoid coils.

E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

A. Furnish replaceable core liquid line filter dryer.

B. Provide filter dryer constructed to permit the removal of the core element without

removing the filter dryer from the line.

PART 3 - EXECUTION

3.1 BRAZING

A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.2 PRESSURE TEST

A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
1. Test joints with a Halide torch or an electronic leak detector.
2. Repair leaks and retest each system until proved tight.

B. Refrigerant piping systems shall be pressure teste for strength and leak tested for tightness in accordance with the requirements of section 1110 Refrigeration Piping System Test in Chapter 11 of the 2021 International Mechanical Code after installation and before being placed in operation. Tests shall include both high and low pressure sides of each system.

3.3 EVACUATION AND DRYING

A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.4 PIPE SIZE

A. Pipe shall be routed and sized per condensing unit manufacturer’s instructions.

3.5 MINIMUM HEIGHT

A. Exposed refrigerant piping installed in open spaces shall be installed 7’-3” or higher above finished floor.

3.6 REFRIGERANT PIPE ENCLOSURE

A. Refrigerant piping shall be protected by locating it within building elements when routed below 7’-3” above finished floor except where located within 6’-0” of the refrigerant unit.

3.7 REFRIGERANT PIPE ENCLOSURE

A. Refrigerant piping shall be protected by locating it within building elements when routed below 7’-3” above finished floor except where located within 6’-0” of the refrigerant unit.

3.8 PIPE IDENTIFICATION

A. Pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation.

B. The minimum height of the lettering of the identification label shall be ½”.

C. The identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For group A2, A3, B2, B3 refrigerants, the identification shall also include the following statement: “DANGER – Risk of Fire or Explosion.” For any group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant.”

3.9 REFRIGERANT PIPE PROTECTION

A. Where A2L and B2L refrigerant piping is located in concealed locations where the pipe is installed in studs, joists, rafters, or similar member spaces and located less than 1.5” from the nearest edge of the member, a shield plate shall be installed for continuous protection. Protective steel shield plates having a minimum of 16 gauge shall cover the area of the pipe plus the area extending 2” or more beyond both sides of the pipe.

B. Refrigerant piping shall be installed as to prevent strains and stresses that exceed the structural strength of the pipe. Pipe must be protected from damaging resulting from vibration, expansion, contraction, and structural settlement

3.10 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.11 STOP VALVES

A. Stop valves shall be installed on the suction inlet and discharge outlet of each compressor or condensing unit and outlet of each liquid receiver for systems containing more than 6.6 lbs of refrigerant.

B. In addition to part A. above, stop valves are also required on the inlet of each liquid receiver and inlet of each condenser where more than one condenser is used in parallel for systems containing more than 100 lbs of refrigerant.

C. Stop valves shall be identified where their intended purpose is not obvious.

END OF SECTION

SECTION 23 31 13
DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

A. Division 23 Mechanical
1. Air Devices
2. Air Handling Units
3. Insulation
4. Terminal Units
5 Fan Coil Units
6. Fans
7. Packaged Rooftop Air Conditioners
8. Testing, Balancing and Adjusting (TAB) of Environmental Systems

B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.

B. An approved contractor for this work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.

B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of

all air handling equipment, and summit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.

B. Submit product data and sealing materials to be used.

C. Submit sound attenuation data.

D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.

B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.

C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
1. Galvanized

D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.

E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.

F. Shower Area Exhaust Systems: Welded 304 Stainless steel.

G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

2.3 ACOUSTICAL DUCT

A. Duct and fittings:
1. Double wall acoustically treated.
2. Annular space packed with fiberglass insulation.
3. Perforated metal liner to provide specific acoustic impedance
4. Insulation 1.0 pcf. 1 inch thick
5. United McGill Acousti-K27 spiral lockseam or approved equal
6. Material as indicated below:
a. Paintable Galvanized Steel

B. Pressure rating and tests as specified for single wall ductwork.

2.4 DUCT SEALING OF SEAMS AND JOINTS

A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
   1. Indoor applications – Foster 32-14
   2. Outdoor applications – Foster 32-17

2.5 FLEXIBLE DUCT LOW PRESSURE

A. Construction:
   1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
      a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
   2. UL 181 Class I air duct label
   3. Reinforced vapor barrier jacket
   4. Rated for use at system pressure (6" wc minimum)
   5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.

B. Fire hazard classification:
   1. Flame spread rating 25 maximum.
   2. Smoke developed rating 50 maximum.

C. Thermal characteristics:
   1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
   2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
   3. 2" minimum wall thickness insulation with 1" overlap

D. Acceptable manufacturers:
   1. Flexmaster
   2. Hart & Cooley
   3. Omniair
   4. Peppertree Air Solutions

2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.

B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
Positive: 12" w.g.
Negative: 5" w.g.

C. The duct shall be rated for a velocity of at least 5500 fpm.

D. Suitable for operating temperature range of -20°F to +250°F.

E. Factory insulate the flexible duct with fiberglass insulation.
   1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)

2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
3. 2" minimum wall thickness insulation with 1" overlap

F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.

G. Acceptable manufacturers:
1. Flexmaster
2. Omniair
3. Peppertree Air Solutions

2.7 FIRE DAMPERS

A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.

B. Acceptable Manufacturers:
1. Ruskin
2. Prefco Products
3. Air Balance
4. Greenheck, Inc.
5. Nailor Industries
6. Pottoroff

2.8 CEILING RADIATION DAMPERS

A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.

B. Acceptable Manufactures
1. Ruskin
2. Prefco
3. Air Balance
4. Phillips
5. Safe-Air
6. Nailor Industries

2.9 WALL LOUVERS

A. Refer to schedule on drawings. Coordinate with Architectural Drawings.

B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.

C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.

D. Louvers shall be AMCA-550 tested and approved.

E. Acceptable manufacturers:
1. American Warming and Ventilation
2. Arrow
3. Greenheck
4. NCA
5. Pottorff
6. Ruskin

2.10 DUCT LINING

A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.11 VOLUME DAMPERS

A. Manual balancing dampers that meet or exceed the following minimum construction standards:
1. Frame 16-gauge
2. Blades 16-gauge
3. Bearings corrosion resistant
4. Concealed linkage
5. Opposed blade dampers

B. Acceptable manufacturer:
1. Ruskin Model MD-35 or approved equal, by
2. Arrow
3. American Warming and Ventilating
4. Nailor Industries
5. Pottoroff

2.12 ACCESS DOORS

A. Round spin-in door of galvanized steel.
1. Fire proof sealing gaskets and quick fastening locking devices
2. Insulated door
3. Conform to the requirements of the NFPA
4. Identification and use of each access door
5. UL label to match the construction in which it is installed
6. Cable attached to door and outer frame
7. Low leakage Access Door

B. Acceptable Manufacturer
1. Flex master, Inspector Series
2. Approved Equal

2.13 COMBINATION FIRE/SMOKE DAMPERS

A. Combination fire/smoke dampers meeting the following requirements:
1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters

Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.

2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
5. Provide UL555S qualified electric actuator at 120 VAC.
6. Provide air-foil type blades.

B. Provide integral sleeves

C. Acceptable Manufacturers:
1. Ruskin
2. Air Balance, Inc.
3. Greenheck, Inc.
4. Nailor Industries
5. Pottoroff

2.14 SMOKE DAMPERS

A. Smoke dampers meeting the following requirements.
1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be

opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.

3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
4. Provide UL555S qualified electric actuator at 120 VAC.
5. Provide air-foil type blades.

B. Provide integral sleeves.

C. Acceptable Manufacturers:
1. Ruskin
2. Air Balance, Inc.
3. Greenheck, Inc.
4. Nailor Industries
5. Pottoroff

2.15 DIFFUSER FITTINGS LOW PRESSURE TAPS

A. Fitting shall meet or exceed the following minimum construction standards:
1. Conical with a base diameter two inches larger than the tap diameter.
2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
a. Through 8 inches: 26 gauge; Damper blade 22 gauge
b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
6. Provide the damper with a self-locking regulator and handle.
7. Provide a 2” sheet metal stand-off to extend the regulator.
8. Flex duct grip area – 2 inches behind retaining bead
9. Flex duct retaining bead – 1 inch from end
10. Conical length of at least 3 inches
11. Barrel length of at least 9 inches

2.16 AUXILIARY DRAIN PANS

A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2”, all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

2.17 DUCTWORK SUPPORTS ON ROOF

A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable height and width. Base material shall be high density / high impact polypropylene with UV

inhibitors and anti-oxidants. Provide with hot dip galvanized framing. Nuts and washers shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.

B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.

C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.

D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.

E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.

F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.

G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.

H. Fire Dampers shall be installed per manufacturer’s recommendations to create a UL rated assembly.

I. Install end bearing at all location where damper shaft penetrates duct wall.

J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.

B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.

C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.

D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
   1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
   2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.

E. Use pushrod operator with locking nut and butt hinges assembly.

F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
   1. Return air ductwork
   2. Outside air branch duct
   3. Exhaust branch duct
   4. Exhaust connections to hoods except kitchen grease hoods or equipment
   5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
   6. At each outside air and return air duct connection to plenum of constant volume units
   7. At discharge side of constant volume boxes
   8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
   9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.

G. Elbows:
   1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
   2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.

H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.

I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

J. Insulated Flexible Duct:
   1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor

barrier jacket shall be tucked inside to conceal insulation material.

2. Construct bends over 45° with sheet metal elbows.

K. Duct Supports:

1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, “Everdur” welded and coated with “Galvabar”.

3.3 PLENUMS

A. Return air plenums shall be rectangular galvanized sheet metal ductwork.

B. Fabricate plenums upstream of fan of 16-gauge material.

C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:

1. Fire Dampers
2. Smoke Dampers
3. Smoke/fire Dampers
4. Outside Air Dampers
5. Duct Mounted Coils (up-stream)
6. Control Dampers

B. Size access door 1" smaller than ductwork.
   1. Available Sizes: 8”, 10”, 12”, 18”, 24”

C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.

D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.

B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.

C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.

D. Do not install liner in multi-zone unit ductwork.

3.7 SEALING OF SEAMS AND JOINTS

A. Seal supply, return, exhaust and outside air duct systems.

3.8 DISHWASHER HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

3.9 SHOWER AREA EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

3.10 KITCHEN EXHAUST DUCT

A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.11 FUME HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 stainless steel construction.

3.12 ACOUSTICAL DUCT

A. Install in the following locations:
1. Gymnasiums
2. Auditorium
3. And/or where indicated on the drawings

3.13 SCREENS

A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2”) mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.14 CONNECTIONS TO LOUVERS

A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.

B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.15 PLENUMS

A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross broken and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.

B. Provide access doors.

3.16 AUXILIARY DRAIN PANS

A. Where coils that have a condensate drain are located above ceiling.

3.17 TESTING OF LOW PRESSURE DUCTWORK

A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.

D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be

visually inspected.

3.18 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

A. As the project progresses, test the ductwork in sections.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Finally as a complete system, test ductwork at a minimum of 2.5” with a maximum allowable leakage of 1% of the total design supply airflow.

D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

SECTION 23 34 16
FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

A. Division 23 Mechanical:
   1. Ductwork
   2. Vibration Isolation
   3. Air Balance
   4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.

B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.

C. Statically and dynamically balance all fans.

D. Motors shall be sized so that they do not operate within the motor service factor.

E. Fans shall be capable of 120% of the scheduled air capacities.

F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

A. Submit fan performance curves with system operating point plotted on curves.

B. Submit manufacturer’s printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cook

B. Greenheck

C. ACME

D. Twin City Fans

2.2 PROTECTIVE COATINGS

A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.

B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.

B. Belt Drives:
1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
3. Provide belt guards and apply the same finish as used on the fan.
4. Oil and heat resistant, nonstatic type belts.
5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.

C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.

D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.

E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.

F. Where motorized damper is scheduled:
1. The motor and damper are specified in the Building Management and Control System Specification.

G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
1. Fan mark as indicated on the Contract Drawings.
2. Serial number
3. Model number
4. Capacity (CFM) and static pressure.
5. Motor HP

6. Motor Amps
7. Manufacturer
8. Motor phase
9. Number of Belts/Make/Size
10. Motor volts

H. Utility Vent Set Fans, provide minimum ¾ inch threaded coupling drain connection at lowest point of housing.

2.4 VENTILATION AND EXHAUST FANS

A. Provide the ventilation and exhaust fans shown on the drawings.

B. Provide each motor with internal overload protection.

C. Provide each belt driven fan with approved, totally enclosed belt guard.

D. Provide approved safety screen where inlet or outlet is exposed.

E. Provide duct flanges where required for connections.

F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.

G. Furnish supply fans with 1” aluminum, washable filter section.

2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

A. Provide the rooftop ventilation and exhaust systems shown on the drawings.

B. Provide each motor with internal overload protection.

C. Components:
1. Aluminum, stainless steel or plastic coated bird guard.
2. Screws and fasteners of stainless steel or nonferrous material.
3. All aluminum construction unless indicated otherwise on fan schedule.

D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.

E. Aluminum base shall be continuously welded curb cap corners.

2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

A. Provide the rooftop intake and relief vent systems shown on the drawings.

B. Provide with aluminum, stainless steel or plastic coated bird guard.
1. Screws and fasteners of stainless steel or nonferrous material
2. All aluminum construction

C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.

D. Aluminum base shall be continuously welded curb cap corners.

2.7 OSCILLATING AIR CIRCULATOR FAN

A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100

B. Totally enclosed motor voltage – 120 Voltage – 60 Hz

C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard

D. Wall Mounted

E. Factory wired 10', 3 conductor with ground molded plug

F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.

B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.

C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x ¼" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.

D. Install curbs and equipment in level position.

E. Ceiling mounted in-line centrifugal blowers
1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
2. Provide sub-structure where required.
3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23 37 13
AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.

B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

A. Titus.

B. Krueger.

C. Nailor Industries.

D. Price

E. Metal-Aire

2.3 ACCESSORIES

A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.

Select extractors similar to Titus Model AG25, tight-closing in the minimum position.

Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.

B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
   1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
   2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION

SECTION 23 41 00
AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air filters and air filter gauges.

1.2 RELATED WORK

A. Division 23 Mechanical.

1.3 SUBMITTALS

A. Submit manufacturer's product data sheets and capacity information as specified.

B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

A. The filter cells:
   1. Pleated media.
   2. Disposable type.
   3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
   4. 16 pleats per linear foot of filter.
   5. 2" thick.

B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
   1. Seal the media pack in a chipboard frame.

C. Rated average dust spot efficiency of not less than 36%.
   1. Average synthetic arrestance in excess of 93% when tested in accordance with the ASHRAE 52-68 test standard.

D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.

E. Initial resistance to air flow:
   1. 300 fpm - 0.12" WG.
   2. 500 fpm - 0.28" WG.

F. UL listed with Class II rating.

G. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the filters and filter gauges in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 81 18
SPECIALIZED PACKAGE ROOFTOP AIR CONDITIONERS (HIGH OUTSIDE AIR)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install a high outside air single-package, single-zone variable air volume unit, electric air conditioner with electric heat for rooftop application.

1.2 RELATED WORK

A. Division 23 - Mechanical.
1. Ductwork
2. Air Balance
3. Electrical provisions for mechanical work
4. Air filtration
5. Vibration Isolation

1.3 PERFORMANCE

A. As scheduled on drawings, with head pressure control to enable unit start and operation down to 20 degrees F ambient.

1.4 QUALITY ASSURANCE

A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

C. System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

D. Unit shall be safety certified by ETL and be ETL US listed.

1.5 SUBMITTALS

A. The equipment listed in this specification section has been designated as a potential long lead order product and requires the Contractor to submit four (4) complete and full copies of the product submittal within 24 hours after proposal pricing has been submitted. The design team will expedite review of the submittals and provide comments so that the Contractor may order / receive equipment to comply with project schedule.

B. Product Data.
1. Literature shall be provided that indicates dimensions, operating and shipping weights, certified capacities, ratings, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.

C. Shop Drawings.
1. Unit drawings shall be provided that indicates assembly, unit dimensions, construction details, service and air flow clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

D. Submit coordination drawings as specified. Give consideration to adjacent structures as they affect air flow patterns.

E. Submit sequence of operation in narrative form.

F. Mark-up a copy of the specifications indicating in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors bolted shut to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

D. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

E. Unit controls shall be capable of withstanding 205°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

1.7 WARRANTY

A. The Packaged Unit Manufacturer shall provide a full machine parts, labor, oil and refrigerant warranty for a period of five years. Warranty shall start the date of the substantial completion certificate. In addition, warranty shall include miscellaneous materials, travel time, incidental expenses, freight/shipping, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty issues.

B. The Packaged Unit Manufacturer shall provide factory certificates for each unit which should include model number, serial number and warranty information as outlined above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

C. All warranty work shall be performed by a factory direct or factory certified service technician. Warranty work shall not be performed by installing mechanical contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier (Houston Direct Sales Office)

B. Daikin

2.2 COMPRESSOR

A. Compressors shall be scroll type with thermal overload protection, and independently circuited. Unit shall include a variable capacity scroll compressors (digital scroll or inverter driven), which shall be capable of modulation from 10-100% of its capacity and allow for airflow turn down to 30% of full flow.

B. Each compressor shall include a crankcase heater.

C. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

D. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

E. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas bypass line, insulated hot gas line and insulated suction line.

F. Unit shall include a factory holding charge of refrigerant R32 or R454B.

G Each compressor shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.

H. The unit shall be provided with discharge temperature controls and shall be capable of stable cooling operation to a minimum unit discharge temperature as scheduled down to 20°F outdoor temperature.

I. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal.

2.3 EVAPORATOR, CONDENSER, AND REHEAT COILS

A. Condenser and reheat coils shall be one of the following construction types:
1. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Long Life Alloy Microchannel shall pass 4500hr salt spray rating uncoated.

2. The condenser coils shall consist of seamless copper tubes mechanically bonded into plate-type fins. The fins shall have full drawn collars to completely cover the tubes.

B. Evaporator coil constructed of copper tubes with mechanically bonded aluminum fins and stainless-steel end casings.

C. Provide evaporator coils with stainless steel casings, end plates, tube supports and top and bottom plates.

D. Provide hail guards for condenser coils.

E. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

F. A primary drain pan overflow safety shall shut off the unit and issue a warning before overflow occurs.

2.4 EVAPORATOR FANS

A. Unit shall be equipped with a direct drive, backward curved airfoil blade, plenum evaporator fan.

B. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.

C. Motor shall contain premium efficiency ODP with self-aligning ball bearings rated for 200,000 hours service with external lubrication ports grouped near the motor access side of the unit. Provide motor HP as indicated on the drawings.

D. Variable frequency drive shall be factory wired and mounted in the unit.

2.5 ELECTRIC HEATING

A. Electric heater shall be controlled by a SCR power controller.

B. Electric heater shall be Underwriters Laboratories or Applied Research Laboratories listed for zero clearance and shall meet the requirements of 2006 National Electrical Code and U.L. 1996 specifications file #E 50663.

C. Each heater shall be furnished with one or more automatic resets as an over temperature safety device(s), serviceable and replaceable, that will be de-energized the heater on over temperature.

D. Terminal box and element frame shall be of heavy gauge (minimum of 20 gauge) galvanized steel, sufficiently formed and braced to assure structural rigidity of the entire heater assembly, terminal box and terminal box cover must be totally enclosed and free of any perforation. Terminal box may have a false bottom design for greater cooling effect for the control components on large terminal boxes.

E. Heating elements(s) shall be high grade nickel-chrome alloy. Heating element(s) shall be held in place with floating steatite bushings. Heating element(s) are field replaceable. For maximum strength, the bracket must completely surround the ceramic bushing and have 1/32 inch total clearance between the bushing and metal. Double threaded stainless steel stud bolts.

F. Each heater shall be furnished with exact wiring diagram on the corner of the terminal box. Internal wiring is stranded copper only wrapped with 105C insulation 600V. Standard contactors per stage shall be 120V control circuit. Terminal block or lugs shall be sizes for installation of 75C copper wire for field wiring. Heaters over 48 amps total shall be sub-divided and circuit fused for protection. Control circuit (120V) shall be wired to the terminal block.

G. All components are recognized or listed components by UL.

2.6 CASING FILTERS AND DUCT CONNECTION

A. Provide a cabinet constructed of galvanized or zinc-coated steel, primed and coated with baked enamel and suitable for outdoor installation.

B. Provide duct connections as indicated on drawings.

C. Units shall include a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seats. Damper blades shall be gear driven and designed to have no more than 15 cfm of leakage per sq. ft. of damper area when subjected to 2 inches W.G. air pressure differential across the damper. Damper assembly shall be controlled by a spring return DDC actuator. Unit shall include outside air bird screen, outside air hood, and barometric relief dampers.

D. Provide motorized outside air damper for shut off and for air flow measuring station to maintain scheduled outside air amounts.

E. Unit shall be equipped with a metal filter frame to match the filter requirements specified in the Air Filtration section.

F. Furnish through-the-bottom electrical service connection.

G. Provide with 304 stainless steel condensate drain pan with positive slope in all directions to outlet.
1. Externally line the condensate drain pan with 1-1/2" foam insulation.
2. Provide a hinged access door with quick release handle adjacent to condensate drain pan for inspection. Install access door on drain connection side of unit.
3. Drain pan shall be insulated with a minimum 2’ thick foam insulation.

H. Double wall casing construction
1. Construct roof, wall, and floor with minimum 2-inch-thick, 2 lb. density, R-13 injected polyurethane foam insulated, double wall panels with thermal break for superior energy efficiency and casing longevity.
2. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
3. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors. Units without full hinged access doors in the cooling coil section are not acceptable.

2.7 CONTROLS

A. Provide safety and operating controls factory wired and mounted in a separate enclosure. Include thermostatic expansion valve, high and low pressure switches and compressor motor overload devices. Furnish a time delay device to prevent short cycling. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections. Include a high condensate level switch that shuts down the unit when a high-water level is detected in the drain pan.

B. Unit shall be provided with a fully functional DDC control system with BACnet MS/TP integration.
1. Unit controller shall be capable of controlling all features and options of the unit.

Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

2. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

3. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

4. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a BACnet network.

C. Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow.
1. Cooling shall be controlled to maintain a discharge air setpoint.
2. The unit supply fan shall modulate based on space temperature.

D. BMCS shall be able to control ON/OFF and leaving air temperature setpoint.

2.8 A2L REFRIGERANT LEAK DISSIPATION SYSTEM

A. Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40, integrated with unit controller.

B. System shall be designed for the life of the unit.

C. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.

D. Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.

E. Factory-installed dissipation system shall use onboard microprocessor and include:
1. Automatic leak detection and dissipation algorithm.
2. Automatic reset after a dissipation event has occurred.
3. Onboard LED with flash code to indicate current unit status and hardware failures.
4. Depressible “Test” button to allow for a system test and recall/reset of leak detection history.
5. 24-v dry contact alarm terminal on dissipation control board to allow for external notification of leak detection.
6. Ability to notify BAS system of dissipation event via readable alarm point unit controller.
7. Recallable dissipation alarm history on unit controller.

F. Dissipation control board shall be accessible via normal maintenance locations and LED

shall be visible.

G. Dissipation system shall “Fail Safe” per UL requirements.

H. Dissipation shall allow smoke and building fire systems to override in case of event.

2.9 GROUND MOUNTED CURB

A. Install a hot dipped galvanized welded steel insulated (R-8 Minimum) welded ground mounted curb with supply air and return air openings as indicated on Drawings. Ground mounted curb shall be hot dipped galvanized assembled after fabrication is complete.
   1. Curb shall be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

   2. Level curb according to manufacturer's recommendations.

   3. Curb height shall be a minimum of 14".

2.9 OUTDOOR FANS

A. Provide propeller type with direct-driven permanently lubricated motor. Fan shall discharge upward.

2.10 THERMOSTAT ASSEMBLY

A. Provide staged heating and cooling as required, automatic changeover and fan control.

2.11 HEAD PRESSURE CONTROL

A. Provide solid state outdoor air fan speed control to permit unit to operate down to 20°F.

2.12 SHORT CYCLE CIRCUIT

A. Provide circuit to prevent compressor from short cycling as a result of a rapid change in thermostat setting. Circuit also prevents compressor restart at least 5 minutes after shutdown.

2.13 CONVENIENCE OUTLET

A. Unit shall be equipped with a factory installed and field wired 120V, 20 AMP GFI outlet in unit cabinet.

2.14 MOTORIZED OUTSIDE AIR DAMPER

A. Low Leakage 14-gauge galvanized steel
   1. Airfoil Blades

   2. Ruskin CD60

2.15 DEHUMIDIFICATION

A. Unit shall be provided with hot gas reheat and factory programmed with a dehumidification cycle.

2.16 HUMIDISTAT

A. Wall Mounted

B. Shall control activation of dehumidification coil

C. Humidity levels between 20% to 80% relative humidity.

2.17 PHASE MONITORING PROTECTION

A. Provide unit with phase monitoring protection to protect motors and compressors against issue associated with phase loss, phase imbalance and phase reversal.

2.18 OPERATING CONTROLS

A. Provide all necessary controls to operate a rooftop unit as a single zone variable air volume system. During cooling mode, the unit will maintain zone cooling setpoints by modulating the rooftop unit supply fan speed more or less to meet the zone load demand-based temperature through the temperature in the space. The unit will maintain discharge temperature to the discharge cooling setpoint by modulating the economizer, if available, and modulating the dx cooling. During heating mode, the unit will maintain zone heating setpoints by modulating the economizer, if available, and staging the electric heater.

B. Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

C. Provide wall or duct mounted CO2 sensor to monitor space occupancy levels within the building by measuring the parts per million of CO2 (Carbon Dioxide) in the air. As CO2 Levels increase, the economizer fresh air damper shall modulate to meet the CO2 space ventilation requirements.

2.19 SERVICE DISCONNECT SWITCH

A. Unit shall be equipped with a factory installed field wired, non-fused disconnect switch with external locking handle.

2.15 ULTRA-LOW LEAK ECONOMIZERS WITH ENTHALPHY CONTROL

A. Unit shall be provide with factory installed ultra-low leak economizer.

B. Ultra-Low Leak economizer dampers shall meet and comply with California’s Title 24 section 140.4 prescriptive requirements for leakage, reliability testing, etc., and ASHRAE 90.1-2013 requirements for damper leakage.

C. Provide economizer with integrated, gear driven opposed blade design type capable of simultaneous economizer and compressor operation.

D. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

E. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

F. Shall be capable of introducing up to 100% outdoor air.

G. Provide outdoor airflow measurement station to maintain outside airflow quantity as supply fan varies.

H. Economizer's barometric relief dampers shall be sized to allow up to 100% relief.
1. Economizer Controls:
a. Meets California's Title 24 section 120.2 mandatory requirements for economizer Fault Detection and Diagnosis (FDD).
b. Economizer controller shall be Honeywell W7220 or equal that provides:
i. 2-line LCD interface screen for setup, configuration and troubleshooting.
ii. On-board FDD detects and alerts when economizer is not operating properly.
iii. Sensor failure loss of communication identification.
iv. Automatic sensor detection.
v. Capabilities for use with multi-speed indoor fan units.
c. Compressor lockout temperature on W7220 is adjustable from –45°F (–43°C) to 80°F (27°C), set at a factory default of 32°F (0°C).
d. Shall be designed to spring return close outside air damper during loss of power.
e. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
f. Utilizes digital dry bulb or enthalpy outside air sensors. Factory-installed economizers available with dry bulb or enthalpy. Dry bulb sensors installed on all field-installed economizer accessories.

2.16 RETURN AIR ENTHALPHY SENSOR

A. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.

2.17 OUTDOOR AIR ENTHALPHY SENSOR

A. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.

2.20 EXHAUST/RETURN SECTION

A. Provide barometric relief gravity type dampers to operate in conjunction with economizer to provide exhaust.

B. Provide factory supplied field installed power exhaust assembly that shall assist the barometric relief damper in the economizer in relieving building pressurization.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to manufacturer's recommendations and as shown on drawings.

B. Unit is to be provided with a through-the-bottom service connection accessory package and must be used for electrical connections to unit. Use bulkhead connectors to make a

waterproof connection.

C. Seal all duct connections to roof curb for air tight connection. Install a 90 degree flanged ductwork connection to the roof curb. Provide and install gasketing around duct flanges. Provide and install gasketing around outer edge of roof curb.

3.2 FACTORY TESTING

A. Each unit shall be factory run tested prior to shipment. Unit shall be tested for DX piping pressurization, charge and operation. All electrical systems shall be powered and check for compliance. Each system shall be tested, verified, and certified by manufacturer prior to shipment. Any unit failing to meet manufacture specifications shall be denied shipment unit until unit passes.

B. A written report for the factory test shall be submitted to the engineer for approval upon request.

3.3 MANUFACTURERS FIELD SERVICES

A. Furnish services of factory direct or factory certified technicians for the time required to leak test, start-up and balance each air unit. Start-up services shall be completed prior to owner demonstration.

B. Start-up items to include full controller check, controls sequence of operation, installation conformance, and general unit operation.

3.4 DEMONSTRATION

A. Demonstration of unit operation and maintenance shall be performed by a manufacturer’s technical representative. Demonstration shall be one 8-hour day and include the instruction of the owner’s personnel in operation and maintenance of units. This time shall be in addition to time required for start-up.

B. Demonstration shall be scheduled with the owner and provide at least a seven (7) day notice to Architect / Engineer of training date.

3.2 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.5 STARTUP

A. Provide the services of a factory trained service technician employed full time by the unit manufacturer to start-up the system, or manufacturer's factory authorized representative under the supervision of the factory trained service technician. Upon completion of the installation, the system shall be started and commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system. The factory authorized representative will verify that accessories are installed and performing the specified functions. (Contractor startup is unacceptable.)

B. The written startup report shall be provided to the owner and engineer upon completion.

C. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.

D. Provide a minimum of 8 hours of BMCS coordination and BMCS setup time. During this time unit manufacturer shall work side by side with BMCS contractor to ensure all communications between the unit BACnet controller and the BMCS is fully functional. A fully functional system includes proper mapping of points in the BMCS.

END OF SECTION

SECTION 23 82 16
HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

A. Submit manufacturer's product data sheets and unit capacity information as specified.

B. Submit manufacturer's Installation, Start-Up and Service Instructions.

C. Submit internal wiring diagram.
   1. Electrical interlocks.

1.3 RELATED WORK

A. Division 23 Mechanical.
   1. Air Handling Units.
   2. Fan Coil Units.
   3. Weatherproof Roof Mounted Air Handling Units.
   4. Ductwork.
   5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

A. Hot water coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for hot water.
      a. Maximum temperature 200°F.

B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations where the incoming air is not filtered, the maximum approved fin spacing is 8 fins per inch.

C. Non-trapping circuit design:
   1. Working pressure 200 psi
   2. Tappings for drain and air vent

D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
   1. Positioned to permit accurate pressure readings.

E. Coils shall be constructed in casings as required for installation.

2.2 DIRECT EXPANSION COOLING COILS

A. DX cooling coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for use with direct expansion refrigeration.

B. Cooling coil face velocity:

1. Not of magnitude to cause moisture to be carried off the coil.
2. Maximum velocity as scheduled.

C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.

D. Coils shall be constructed in casings as required for installation.

E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 ELECTRIC HEATERS

A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.

B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.

C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.

D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.

E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.

F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.

G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.

H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

SECTION 23 82 18
DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall or cassette fan coil section with wired wall mounted thermostat and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with inverter driven compressor, pre-charged with R32 or R454B refrigerant. Air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

A. Refrigerant Piping.

B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute’s (AHRI) Standard 210 and bear the AHRI Certification label.

D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).

E. A pressure charge of R32 or R545B refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.

F. A dry air holding charge shall be provided in the indoor section.

G. UL Compliance: Comply with UL 60335-2-40.

1.5 WARRANTY

A. Unit shall have a manufacturer’s parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. Warranties shall start at the date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier (Houston Direct Sales Office)

B. Daikin

2.2 INDOOR UNIT GENERAL

A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.

B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.

C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.3 INDOOR UNIT CABINET

A. The casing shall have a smooth front, top return, in a white finish.

B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.

C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.4 INDOOR UNIT FAN

A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.

B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).

D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.

E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 INDOOR UNIT FILTER

A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 INDOOR UNIT COIL

A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.

B. Tubing shall have inner groves for high efficiency heat exchange.

C. All tube joints shall be brazed with PhosCopper or silver alloy.

D. The coil shall be pressure tested at the factory.

E. A sloped condensate pan and drain shall be provided under the coil. Drain connections shall be provided at each end of the drain pan.

F. An integral condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.

G. An external condensate pump shall be provided where indicated on the drawings equal to Little Giant VCMX. Pump accessories shall include anti-sweat sleeve, galvanized steel wall mount bracket or shelf equal to Nexus Model 11AS-K9. Condensate pump shall be secured to wall bracket.

2.7 INDOOR UNIT ELECTRICAL

A. Power for the indoor unit shall be supplied from the outdoor unit.

B. Power supply shall be as indicated on the drawings.

C. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.

D. The indoor unit shall not have any supplemental electrical heat elements.

2.8 INDOOR UNIT CONTROL

A. This system shall have a wired wall mounted controller to perform input functions necessary to operate the system. The controller shall consist of the following features:
1. Color Touch Screen Interface
2. Power On / Off Button
3. Mode Selector
4. Temperature Setting
5. Timer Control
6. Fan Speed Select
7. Auto Vane Selector
8. Role based configuration with password protection
9. Integrated BACnet MS/TP connectivity

B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.

C. There shall be a 24 hour On / Off timer.

D. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired remote controller, providing emergency operation and controlling the outdoor unit.

E. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

F. The system shall be capable of automatic restart when power is restored after power interruption.

G. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

A. The outdoor unit is designed specifically for use with the indoor units. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.

B. When refrigerant lines are exposed on exterior of building provide “LINE-HIDE” line set cover system.
1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
2. Assembly Screws, stainless steel.

2.10 OUTDOOR UNIT - CABINET

A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.

B. Case and mounting feet shall be as follows:
1. The base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
2. The base for the MS-A12WA shall have a galvanized steel base with welded mounting feet.

C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 OUTDOOR UNIT - FAN

A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.

C. The fan shall be provided with a raised guard to prevent contact with moving parts.

D. The outdoor unit shall have horizontal discharge airflow.

2.12 OUTDOOR UNIT - COMPRESSOR

A. The compressor shall be a high performance, inverter driven rotary type.

B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.

C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.13 OUTDOOR UNIT - OPERATION

A. The outdoor unit shall have an accumulator.

B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.

C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.

D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.14 OUTDOOR UNIT - ELECTRICAL

A. Power supply shall be as indicated on the drawings.

B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

2.16 A2L REFRIGERANT LEAK DISSIPATION SYSTEM

A. Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40, integrated with unit controller.

B. System shall be designed for the life of the unit.

C. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.

D. Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.

E. Factory-installed dissipation system shall use onboard microprocessor and include:
1. Automatic leak detection and dissipation algorithm.
2. Automatic reset after a dissipation event has occurred.
3. Onboard LED with flash code to indicate current unit status and hardware failures.
4. Depressible “Test” button to allow for a system test and recall/reset of leak detection history.
5. 24-v dry contact alarm terminal on dissipation control board to allow for external notification of leak detection.
6. Ability to notify BAS system of dissipation event via readable alarm point unit controller.
7. Recallable dissipation alarm history on unit controller.

F. Dissipation control board shall be accessible via normal maintenance locations and LED shall be visible.

G. Dissipation system shall “Fail Safe” per UL requirements.

H. Dissipation shall allow smoke and building fire systems to override in case of event.

I. Sequence upon receiving leak detection signal from any indoor unit:
   1. Switch to COOL operation regardless of previous operation mode.
   2. Close liquid shutoff valve and run pump-down operation.
   3. Upon completion of pump-down operation, close suction shutoff valve.
   4. Stop compressor operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.

B. Install units on vibration isolation pads.

C. Ensure unit provided will meet the refrigerant and line lengths required by the installation as indicated on the drawings.

3.2 CONTROL WIRING

A. BMCS contractor shall provide and install all low voltage control wiring associated with the new split systems. This includes but not limited to wiring to temperature sensors, low voltage wiring between indoor and outdoor units. Installation shall be in accordance with manufacturer’s installation requirements.

3.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendations.

B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.5 START-UP

A. Follow the manufacturer's start-up procedures.

B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring op suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION

SECTION 25 00 00
ENERGY MANAGEMENT AND CONTROL SYSTEMS

GENERAL CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply this section.

1.1 GENERAL

A. Scope of Work:

1. The following existing campuses are controlled by an existing Automated Logic Control system installed by Automated Logic Houston. Expand existing building management and control system as required to incorporate all equipment being replaced or added including all new valves, dampers, actuators, sensors and updated graphics.
   a. Hunters Glen ES
   b. Palmer ES
   c. Ridgegate ES

B. 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.

C. The Workstations, Primary Network Server, and Network Area Controllers shall be connected by an EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in: IEEE STD 802-1990: IEEE Standards for Local and Metropolitan Networks, Overview and Architecture.

D. If the EMCS contractor wishes 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 filed 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.

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. System shall be compatible across various devices including iPhone, Android and Windows phones and various tablets running these operating systems.

F. All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2010, 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 HTML5 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 unlimited 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 other.

1. Mechanical devices installed under Division 23 by the mechanical contractor or other suppliers: temperature sensing thermowells; automatic control valves; pipe taps for flowmeters; water pressure sensors and switches; automatic control dampers not installed in air handling unit mixing boxes or louver schedules; damper actuators for variable air volume (VAV) terminal units; mounting cost of controller and actuator for 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, variable frequency drives (VFD) and etc.

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 contractor 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. ANSI/ASHRAE Standard 135-2010, 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. National Electrical Code (NEC).
8. FCC Part 15, Subpart J, Class A.
9. National Institute of Standards and Technology (NIST).
10. IEEE STD 802-1990: IEEE Standards for 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 or Modbus 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, and domestic water metering.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus 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 or Modbus 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 or Modbus 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.

3. System shall be configured so that lighting control modules on physical wired modules controlled by web interface control schedule.

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. Acceptable manufacturers shall be Automated Logic

B. 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 EMCS/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 support service.

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, manufacture 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.

9. Provide detail points list on every piece of equipment.

10. Provide technical cut sheets showing all relevant devices and/or information highlighted to distinguish what was installed.

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 BACnet Interoperability Building Blocks (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.

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 electronic copies on a USB Drive with all of the record documentation in PDF format and a USB Drive containing backup copies of all installed software and graphics.

6. Provide an excel spreadsheet for tracking and maintenance by equipment type. Coordinate with owner for database and template requirement.

7. 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. If manufacturer warranty on a product is longer than (1) year, contractor is responsible for honoring and coordinating the warranty of that product up to the end of manufacturer warranty. 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. All warranty work shall be performed by the EMCS contractor’s local service group.

B. 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.

C. 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 6 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 WAN/LAN, with appropriate web browser software installed.

1.10 ENGINEERING WORKSTATION (EWS)

A. The Engineering Workstation shall be any personal computer or virtual pc and/or server, connected to the WAN/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) and files, to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.

B. The EMCS shall provide one virtual pc and/or server which is compatible with the performance required by the EMCS Engineering Software. It shall be able to be reached locally and remotely as needed.

PART 2 - PRODUCTS

2.1 PRIMARY NETWORK SERVER (PNS)

A. The EMCS Contractor shall provide and install the Primary Network Server as part of this system if compatible PNS is not already in place. 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 HTML5 formats.

3. Synchronize controller databases, database storage scheduling, control and energy management routines

4. Alarm processing and routing shall include email, SMS text messages and paging as needed by the owner.

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 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. A report log of manually overridden points shall be part of the management system.

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 set-points 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 at the very minimum the following open system drivers;

a. BACnet/IP

b. Modbus TCP

C. Network Server Platform Requirements

1. Rack-Mounted Server Computer Hardware: DELL PowerEdge R230 or equal, Intel Xeon Quad E3-1225 V53.3 GHz or higher, 16GB RAM, 1TB harddrive, video card, 22” color monitor, and Ethernet adapter 1Gbps or higher.

2. Operating system software shall be Microsoft Windows 10 Professional or higher.

2.2 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. It is contractor responsibility to ensure that a single NAC is not overloaded beyond 85% in any manner. If threshold is meet, contractor shall install an additional NAC and redistribute the load. 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 at the very minimum the following open system drivers;

1. BACnet/IP
2. BACnet MS/TP
3. Modbus TCP
4. Modbus RTU

If additional drivers or modules are needed, contractor must provide at no extra cost to owner.

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.

2.3 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 the ability to have different 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. The alarm console shall pop up every time user logs in. In addition, system shall have a map of the district with schools in critical alarm flashing in red.

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 stage and 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.

2.4 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.

2.5 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.) Distributed control of one singular piece of major mechanical equipment shall not be performed by multiple controllers.

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. Building scheduling shall be downloaded into flash memory in order to function during network outages.

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.

2.6 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.

2.7 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.

2.8 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, r text file.

D. Interactive Maps: Implement 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 HTML5 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.

2.9 ENERGY SAVING PROGRAMS

A. Demand Limiting: Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.

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.

2.10 FIELD INSTRUMENTATION

A. Temperature Sensors: All temperature sensors shall be thermistor type, factory-calibrated to within 1 °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 ± 1 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 +/- 50 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. 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.

2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall-mounted enclosure with white cover.

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.

D. Pressure Transducers:

1. Air pressure sensor: The pressure sensors shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA.

2. Water pressure sensors: The pressure sensors shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. Sensor shall be installed with a valved piping bypass and bleed off for each port.

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. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct.

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. The dual-technology occupancy ceiling mounted sensor 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.

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.

2.11 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.

2.12 WATER FLOW METERS

A. Insertion Turbine Flow Meters shall be provided at every Air Handling Unit and for HVAC applications in piping larger than 2 inches. The flow meter shall have a stainless steel insertion probe with non- metallic rotors; 2.0 % accuracy of actual reading from 0.4 to 20 ft/s; turndown ratio of at least 50:1; pulse outputs proportional to flow rate for monitoring by the EMCS. The flow meter shall be single turbine type on applications with 20 diameters of pipe upstream and 5 diameters of pipe downstream. The flow meter shall be a dual turbine type on applications with less than 20 diameters of pipe upstream and 5 diameters of pipe downstream. Provide full port valve to allow for removal and re-insertion without disruption to the water service, to be installed by Division 23. Acceptable manufacturer shall be Onicon.

B. Inline nutating-disk type flow meters shall be provided for domestic water and cooling tower metering applications. The meter shall include a pulse output for monitoring by the EMCS. Provide meter to be installed by Division 23.

2.13 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 +/-0.14° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C).and 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 be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

2.14 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.

2.15 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 three 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 3-way water coil control valves.

B. Pressure Independent Characterized Control Valves (PICCV) 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 PSID 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. The PICCV valves shall be sized for the scheduled flow and not pressure drop. Valves shall be Belimo PICCV or approved equal

1. NPS 2” and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O- rings and a brass or TEFZEL characterizing disc. Close off pressure rating of 200 psi.

2. NPS 2-1/2” through 6”: GG25 cast iron body according to ANSI Class 125,

standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc. Close off pressure rating of 100 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. Belimo F6 and F7 series or approved manufacturer.

F. Control Valve Actuators for PICCV, CCV 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. Interior actuator housings shall be NEMA-2 rated. Exterior housings shall require a weather shield or shall be NEMA-4 rated. Provide visual mechanical position indication

2. 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.

3. Normal and failure positions shall be as indicated in the operating sequences. Provide spring return action per the sequences.

4. 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.

5. 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.

6. 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.

7. 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.

2.16 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 following types of refrigerants regardless of refrigerant type using sequential sampling and multi-point monitoring method: CFC, HCFC and HFC as provided with the chillers.

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. Signage at all entry points to the chiller room shall be installed. 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. 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.
7. 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.
8. Provide two (2) additional particulate filters and zero gas filter cartridges.
9. 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.
10. Provide BACnet MS/TP interface to EMCS. Provide Strobe/Horns and Emergency Push Buttons.
11. 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.
12. 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

13. Gas Monitoring System shall be a Mine Safety Appliances Company Chillgard RT Refrigerant Monitor or equal.

2.17 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.

2.18 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. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.

2.19 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.

2.20 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.

2.21 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, 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, Test and Balance and Commissioning Agent 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. 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.

G. Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof

H. 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”.

I. 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.

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 and Commissioning Agent 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. Ownder has final final approval and decision on all graphic templates.

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 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 and Commissioning Agent, 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, owner and commissioning agent.

3.7 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.

PART 4 - SEQUENCE OF OPERATIONS

A. The following are sequences of operations which will be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences will be provided and connected to the EMCS.

B. Equipment interfaces are acceptable for providing information but each piece of equipment (including but not limited to chillers, VFD's, unitary equipment, etc.) shall have a hard wired point for start/stop and speed control.

C. All Points added by Engineer and/or Control Contractor needed for the sequences shall be identified in the Submittals and Project Record Documents.

D. All VFD's and actuators shall have feedback that reports to the EMCS.

E. All units to have economizer sequences and economizer fault detection and diagnosis capabilities.

F. Flow meters at air handlers shall be integrated into the EMCS.

EXHAUST FANS

- Fan start/stop – DO
- Fan status – DI
- Outside Air Damper – DO

Interlock exhaust fans to run with AHU’s serving the same area and run when the AHU’s are operating in the occupied mode with their OA Dampers open. The exhaust fans shall remain off even during the scheduled occupancy time based on a global command from a shelter in place (building shutdown) button or based on a summer mode schedule.

Fans controlled by local thermostat shall be monitored.

Provide interlocks as schedule on plans unless shown elsewhere.

Space exhaust fans that are interlocked with packaged units shall be disabled when the unit enters economizer mode.

SINGLE PACKAGE DX RTU W/ WITH HOT GAS REHEAT, MODULATING COMPRESSOR AND ELECTRIC HEAT (SPECIALIZED PACKAGED ROOFTOP AIR CONDITIONER)

- Space temperature – AI
- Space humidity – AI
- Carbon Dioxide – AI
- Cooling Coil Discharge air temperature – AI
- Return air temperature - AI
- RTU fan status – current switch – DI
- RTU fan VFD – AO
- DX Cooling – Modulating as necessary- DO
- Heating – Modulating as necessary – DO
- Electric Heater Discharge air temperature – AI
- Hot Gas Reheat – Modulating as necessary – DO
- RTU fan start/stop – DO
- Powered exhaust fan start/stop - DO
- Outdoor air damper – AO
- Outdoor airflow measurement station – AI
- Factory A2L Refrigerant Leak Detection Alarm – DI

GENERAL:

Each rooftop unit shall be provided with a cooling section, hot gas reheat section, electric heater, supply fan section, and an economizer section with outside/return air damper with powered exhaust. The temperature control system contractor shall provide a 0-100% modulating outside air damper with spring return. The temperature control system contractor shall provide a 0-100% actuator. The temperature control system contractor shall provide temperature and humidity sensors. The space temperature sensor shall be provided with a local override button. The space carbon dioxide sensor shall be provided with a digital display covered with a blank faceplate. The temperature control system contractor shall provide a dedicated stand-alone DDC controller for each unit. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.

FAN CONTROL:
Fan speed shall be controlled by the EMCS and shall vary to maintain space temperature. The air volume of the fan can range from 100% to 50% (adjustable per manufacturer) of the air quantity specified or to the outside air percentage whichever value is larger.

OUTSIDE AIR CONTROL:
During all occupied modes the outside air damper shall be controlled to the effective minimum adjustable position. The outside air damper shall be closed during the unoccupied mode, morning warm-up and pre-cool modes or when the outside air temperature falls below a Low Ambient Damper Lockout Setpoint [38°F], operator adjustable. Control outside air supply rate using a carbon-dioxide based demand ventilation control strategy. The outside air and return air dampers shall modulate to provide ventilation CFM to maintain CO2 levels in the spaces. The outside air damper shall be initially set at the minimum position. The dampers shall incrementally increase/decrease to maintain CO2 levels. The EMCS shall monitor CO2 levels in the return air duct. Upon CO2 value rising above 1100 ppm, the outside air damper shall modulate open from the normal position to maintain the CO2 level at 1100 ppm. Once CO2 values fall below set point (1100 ppm), the outside air CFM shall return to its minimum position.

TEMPERATURE CONTROL:
Warm-up: The EMCS shall determine the required warm-up period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied heating setpoint of 69°F (adjustable). Once the occupied heating setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.

Cool-down: The EMCS shall determine the required cool-down period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied cooling setpoint temperature of 74°F (adjustable). Once the occupied cooling setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.

Dehumidification Mode: When the space temperature set point is satisfied, and the relative humidity in the space is above 58% (adj.) the unit shall operate in dehumidification mode. A room humidity sensor shall override the operation of the DX cooling control to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot gas reheat to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

Unoccupied Mode: In the unoccupied mode of operation, the outside air supply fan and unit outside air damper shall be fully closed and the supply fan shall cycle with the unit's heating and cooling modes. The DDC controller shall enable the heating or cooling as required to maintain the unoccupied heating and cooling setpoints (initially 55°F heating and 82°F cooling) as sensed by the space temperature sensor. Upon a rise in space temperature above the unoccupied cooling setpoint, the DDC controller shall enable the mechanical cooling. On a drop in space temperature below the unoccupied heating setpoint, the DDC controller shall enable the gas heating. If the relative humidity rises above set point (initially 58%), then the unit shall energize the dehumidification mode until the relative humidity is lowered to 56% (adj).

The space temperature sensor shall have an override pushbutton. Whenever the override pushbutton is depressed, the unit shall be indexed to the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.

Occupied Mode: In the occupied mode of operation, the unit supply fan shall modulate with a call for heating or cooling. The DDC controller shall energize the heating and cooling as required to maintain the occupied heating and cooling setpoints (initially 69°F heating, 74°F cooling) as sensed by a space temperature sensor with digital display and pushbutton override. Space set point shall be user adjustable within ±2°F (adj.). A room thermistor sensing space temperature with digital display and pushbutton override through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint (initially 69°F heating, 74°F cooling). Space set point shall be user adjustable within ±2°F (adj.).The air volume of the fan can range from 100% to 50% (adjustable per manufacturer) of the air quantity specified or to the outside air percentage whichever value is larger. A DX cooling coil leaving air temperature sensor through the Direct Digital Control Panel shall modulate the compressors to maintain the leaving air temperature as scheduled. When the fan is at minimum speed of its specified air quantity and the room temperature is below the room setpoint, the room thermistor shall modulate DX cooling and electric heater in sequence to maintain the desired space temperature. A room humidity sensor shall override the operation of the DX cooling control to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot gas reheat to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

REFRIGERANT LEAK DETECTION:
If the factory A2L refrigerant leak detector is triggered, BMCS shall receive an alarm and, through internal controls, disable compressor, shut off refrigerant valves, enable unit supply fan, and deactivate all heat associated with the system. When the A2L refrigerant leak detection system is reset, all systems shall go back to normal operation. Refer to equipment specifications for additional information on the A2L refrigerant leak detection system and coordinate with equipment manufacturer to ensure all points and sequence of operations are in compliance with manufacturer requirements.

CONSTANT VOLUME AIR HANDLING UNIT (HEATING/ COOLING)

- Space temperature – AI
- Space humidity – AI
- Leaving air temperature (provide on all single zone and multizone units for each zone) – AI
- Air handler fan status – current switch - DI
- DX Cooling – Condensing Unit - DO
- Air handling unit fan start/stop - DO
- Outdoor air damper – AO
- Return Air CO2 - AI
- Freeze Status – DI
- Duct Heater - DO

A. System Off - When the system is off:
   1. All the fans shall be off.
   2. The outside air damper shall be closed.
   3. All control loops shall be disabled.

B. Initiation of System Start-Up - System start-up shall be initiated:
   1. By an operator manually entered command at the CMCS.
   2. Automatically by the EMCS based on optimal start, night setup, time schedule, restart following a fire alarm, or restart following a power failure.

C. System Operation - When system start-up has been initiated, the following sequences shall be implemented:
   1. The supply air fan shall start.

2. The electric duct heater shall be controlled to maintain the heating space temperature setpoint.
3. The DX cooling coil shall be controlled to maintain the cooling space temperature setpoint.

D. Outside Air Damper Control - During all occupied modes the outside air damper shall be controlled to the effective minimum adjustable position. The outside air damper shall be closed during the unoccupied mode, morning warm-up and pre- cool modes or when the outside air temperature falls below a Low Ambient Damper Lockout Setpoint [38°F], operator adjustable. Control outside air supply rate using a carbon-dioxide based demand ventilation control strategy. The outside air and return air dampers shall modulate to provide ventilation CFM to maintain CO2 levels in the spaces. The outside air damper shall be initially set at the minimum position. The dampers shall incrementally increase/decrease to maintain CO2 levels. The EMCS shall monitor CO2 levels in the return air duct. Upon CO2 value rising above 1100 ppm, the outside air damper shall modulate open from the normal position to maintain the CO2 level at 1100 ppm. Once CO2 values fall below set point (1100 ppm), the outside air CFM shall return to its minimum position.

H. Setpoints - The system shall have the following setpoints:
1. Space temperature setpoint shall be 69 Deg. F. for heating and 74 Deg. F. for cooling.
2. Unoccupied temperatures shall be 55 Deg. F. for heating and 85 Deg. F. for cooling
3. Freezestat setpoint shall be set at the device for 35 Deg. F.

I. Initiation of System Shutdown - System shutdown shall be initiated:
1. By operator entered manual command.
2. Automatically by the EMCS base on time schedule or optimal stop.
3. By the fire alarm system. The EMCS shall automatically set the control relay to the off state.

END OF DIVISION

SECTION 26 01 00
COMMISSIONING OF ELECTRICAL SYSTEMS

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 commissioning process requirements for electrical systems, assemblies, and equipment.

B. Related Sections:
1. Division 01 Section 016500 – “GENERAL COMMISSIONING REQUIREMENTS” for general commissioning process requirements.
2. Division 22 Section 220100 – “COMMISSIONING OF PLUMBING SYSTEMS”.
3. Division 23 Section 230100 - “COMMISSIONING OF MECHANICAL SYSTEMS”.

1.3 DEFINITIONS

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

1.4 CONTRACTOR’S RESPONSIBILITIES

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

G. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

H. Provide test data, inspection reports, and certificates for Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:
1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.6 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall conduct Pre-functional Testing to document compliance with installation and start-up checklists prepared by Commissioning Authority for the Division-26 items.

B. Request verification of Pre-functional checklists by CxA prior to proceeding with system start-up and Functional Testing of systems.

C. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for issues relating to pre-functional checklists and testing, including list of systems to be commissioned, description of process, details on non-conformance issues relating to pre-functional checklists and test.

D. Contractor shall participate in Pre-Functional testing activities to document electrical work associated with mechanical and plumbing systems.

3.3 SYSTEM START-UP, TESTS & INSPECTIONS

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until General Contractor has completed start-up and resolved all operating deficiencies.

B. Contractor is solely responsible for all tests and inspections required by the Authority Having Jurisdiction (AHJ). All test reports and certificates required by the AHJ shall be submitted prior to Functional Testing.

C. Contractor shall provide no less than 48 hours’ notice prior to conducting tests specified in other sections of the specifications, including:
1. Generator and transfer switch testing
2. Grounding tests

3.4 FUNCTIONAL TESTING PREPARATION

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Check all notification and initiation devices and interlocks with associated systems during each mode of operation.

F. Testing Instrumentation: Provide instrumentation and personnel as required to conduct tests.

3.5 FUNCTIONAL TESTING PROCEDURES OF SYSTEMS TO BE COMMISSIONED

A. Lighting Systems:
1. Light Fixtures: Verify all lamps work without flicker.
2. Light Switches: Verify switches control lights per design
3. Lighting Controls:
   a. Verify sensors pick up motion and turn on lights immediately.
   b. Verify that lights turn off after specified time.
   c. Verify sensor coverage includes entire room area being sensed.
   d. Verify sensor does not pick up occupancy outside the area sensed.
   e. For ceiling mounted occupancy switches, verify light switches still function in circuit.

B. All Electrical and Electrically Powered Equipment
1. Inspect electrical wiring and grounding for proper connections, color coding, and quality of installation.
2. Verify supply voltage, all hot legs.
3. Verify amperage is within allowable limits.
4. Inspect for physical damage, proper installation, anchorage.
5. Verify equipment runs smoothly and quietly.
6. Verify operation of safeties.
7. Verify all required means of disconnect are in place.
8. Verify maintenance and NEC clearances are maintained.

C. Service Grounding Test:
1. CxA will witness ground tests to be conducted by Contractor in accordance with specifications. Contractor will provide CxA a minimum 48 hours advance notice of test so that CxA may be witness, or he shall re-test in CxA’s presence. Ground resistance testing is to include lightning protection system as well as electrical power systems.
2. Provide ground test report for review by CxA.

D. Electrical Distribution System
1. Switchboards and Panelboards.
   a. Wiring:

1) Verify wiring connections are secure.
2) Verify ground wires properly terminated, panels are grounded.
3) Verify wiring color coding is proper.

b. Verify panel is properly identified.
c. Verify load indicated in circuit directory is actual load served in space (by opening circuit breaker and observing response in space).
d. Verify load identification is adequately descriptive of load.
e. Verify phase rotation
f. Verify phase to phase and phase to neutral volts.
g. Document phase balance.

2. Receptacle and Device Test:
   a. Test receptacles with a receptacle circuit tester for proper polarity.
   b. Test each receptacle or branch circuit breaker having ground-fault circuit protection.

E. Transformers
1. Verify primary and secondary voltages are within acceptable range and secondary voltage taps (where applicable) are appropriate.
2. Document phase to phase and phase to neutral voltages.
3. Document ground resistance
4. Verify transformers operate without “hum”.

F. Emergency Generator Systems and Transfer Switches
1. Verify phase rotation and consistency.
2. Notify CxA to witness manufacturer’s start-up procedure to include:
   a. No-load test
   b. Load-bank test
   c. Building-load test (witness activation of transfer switch and generators upon a real building power loss)
   d. Other tests as specified
   e. Provide copy of manufacturer’s start-up report.
3. Document response of building systems upon a real building power-loss, activation of generator, and return of normal power.
4. Provide infrared scanning report.

3.6 TRAINING

A. Refer to sections 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.7 O&M MANUALS

A. Refer to sections 016500 - GENERAL COMMISSIONING REQUIREMENTS

END OF SECTION

SECTION 26 01 05
ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
   1. Table of Contents for each element
   2. Contractor information
   3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
   4. All parts and maintenance manuals for items of equipment
   5. Warranties (without starting dates)
   6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
   7. Operating and maintenance procedures.
   8. Form of Owner's Training Program Syllabus (including times and dates)
   9. Control operations / equipment wiring diagrams
   10. Coordination Drawings
   11. Schedule of Lamps, Light Engines
   12. Schedule of Ballasts and Drivers
   13. Schedule of Fuses
   14. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the completed manuals in final electronic form to the Architect / Engineer.
   1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
   2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.

D. The Architect / Engineer shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
a. Size: 8-1/2" x 11"
b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
a. Provide reinforced punched binder tab and bind in text.
b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
a. Title of Project
b. Identity of separate structures as applicable
c. Identity of general subject matter covered in the manual.
6. Binder as specified

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
a. Contractor, name of responsible principal, address and telephone number
b. A list of each product required to be included, indexed to content of the volume.
c. List with each product, name, address and telephone number of:
1) Subcontractor or installer
2) Maintenance contractor as appropriate
3) Identify area of responsibility of each.
4) Local source of supply for parts and replacement
d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
a. Include those sheets pertinent to the specific product.
b. Annotate each sheet to:
1) Identify specific product or part installed.
2) Identify data applicable to installation.
3) Delete references to inapplicable information.
3. Drawings:
a. Supplement product data with drawings as necessary to illustrate:
1) Relations of component parts of equipment and systems

2) Control and flow diagrams
b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
c. Do not use Project Record Documents as maintenance drawings.
4. Written text as required to supplement product data for the particular installation:
a. Organize in consistent format under separate headings for different procedures.
b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued
a. Provide information sheet for Owner's personnel, giving:
1) Proper procedures in event of failure
2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
a. Description of unit and component parts:
1) Function, normal operating characteristics, and limiting conditions.
2) Performance curves, engineering data and tests.
3) Complete nomenclature and commercial number of replaceable parts.
b. Operating procedures:
1) Start up, break-in, routine / normal operating instructions
2) Regulation, control, stopping, shut down and emergency instructions
3) Summer and winter operating instructions
4) Special operating instructions
c. Maintenance procedures:
1) Routine operations
2) Guide to trouble-shooting
3) Disassembly, repair and reassembly
4) Alignment, adjusting and checking
5) Routine service based on operating hours
d. Servicing and lubrication schedule
1) List of lubricants required
e. Manufacturer's printed operating and maintenance instructions.
f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
1) Electrical
2) Controls
3) Communications
g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
1) Predicted life of part subject to wear
2) Items recommended to be stocked as spare parts
h. Schedule of fuses
i. Complete equipment field accessible internal wiring diagrams
j. Schedule of lamps
k. Schedule of ballasts
l. Each Contractor's coordination drawings
m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
n. Other data as required under pertinent sections of the specifications

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 26.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.

B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Electrical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department adopted codes with amendments
5. National Electrical Code with local amendments
6. State Regulatory Agencies
7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
9. International Energy Conservation Code
10. National Electrical Safety Code

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 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 has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.

B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or another recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
1. Underwriters Laboratories, Inc. (UL)
2. Factory Mutual Research Corp. (FMRC) (also referred to as “Factory Mutual Global,” or “FM Global”)
3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
4. Canadian Standards Association (CSA)
5. A complete listing of acceptable NRTLs is published on the OSHA website at http://www.osha.gov/dts/otpca/nrtl/.

C. Where material and equipment are not labeled, listed, or recognized by any NRTL, provide a manufacturer’s Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.

D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner’s AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.

E. Codes and Standards applicable to this Division:
1. ANSI – American National Standards Institute
   a. ANSI Z535.1, Safety Colors
   b. ANSI Z535.2, Environmental and Facility Safety Signs
   c. ANSI Z535.3, Criteria for Safety Symbols
   d. ANSI Z535.4, Product Safety Signs and Labels
2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
   a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings [ANSI, IESNA]*
3. ASTM – American Society for Testing and Materials
4. CBM – Certified Ballast Manufacturers
5. ICC – International Code Council
   a. International Building Code® (IBC)
   b. International Existing Building Code® (IEBC)
6. ICEA – Insulated Cable Engineers Association
   a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
7. IEEE® - Institute of Electronics and Electrical Engineers
   a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
   b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plans* (“Red Book”)
   c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* (“Green Book”)

d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* (“Gray Book”)
e. IEEE Std 242™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* (“Buff Book”)
f. IEEE Std 315™, *Graphic Symbols for Electrical and Electronics Diagrams*
g. IEEE Std 399™, *Recommended Practice for Power Systems Analysis* (“Brown Book”)
h. IEEE Std 446™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* (“Orange Book”)
i. IEE Std 493™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* (“Gold Book”)
j. IEEE Std 519™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
k. IEEE Std 739™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* (“Bronze Book”)
l. IEEE Std 902™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems* (“Yellow Book”)
m. IEEE Std 1015™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* (“Blue Book”)
n. IEEE Std 11oo™, *Recommended Practice for Powering and Grounding Electronic Equipment* (“Emerald Book”)
o. IEEE Std 1584™, *Guide for Performing Arc-Flash Hazard Calculations*

8. IESNA – Illuminating Engineering Society of North America
   a. IESNA *Lighting Handbook*, Ninth Edition
   b. IESNA RP-1, *American National Standard Practice for Office Lighting*
   c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
9. NECA – National Electrical Contractors Association:
   a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
   b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
   c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
   d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
   e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
   f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
   g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
   h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)* [ANSI]
   i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
   j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
   k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
   l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
   m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
   n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]

o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI]
t. NECA 420, *Standard for Fuse Applications* [ANSI]
u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]

10. NEMA – National Electrical Manufacturers Association
11. NETA – International Electrical Testing Association, Inc.:
    a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
12. NFPA – National Fire Protection Association:
    a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection*®
    b. NFPA 70™, *National Electrical Code® (NEC®)*
    c. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
    d. NFPA 101®, Life Safety Code®
    e. NFPA 110, *Standard for Emergency and Standby Power Systems*
    f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
    g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
    h. All other NFPA codes and standards except NFPA 5000
13. OSHA – Occupational Safety and Health Administration
14. IECC – International Energy Conservation Code
15. ISO – International Organization for Standardization
16. State and Local Energy Conservation Code
17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of

the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.

C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.

D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducibles and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
   3. Three sets of blue-line prints of each contract as-built drawing.
   4. Three sets of pdf prints of each contract as-built drawing on CD.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer’s Seal, name, address, and logo from drawings.
   3. Mark documents RECORD DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY:
   5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.

6. Indicate exact location of all underground electrical raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all outdoor lighting poles and equipment.
12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
14. Cloud all changes.
15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
2. The responsibility for alignment of motor and driven equipment is specified in the related division.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.

B. Manufacturer’s warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.

C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

A. General: Refer to Division 1 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

A. 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. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.

2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
   a. Utility Power: White letters on black background
      Generator Power (White letters on red background
      UPS Power: White letters on blue background
      Load Bank Circuits: White letters on green background
      Solar or Wind Power Generation: White on orange background
   b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “PANEL HA –fed from MDP-6 located in Mech. Rm. 100”). The words “fed from” and “located” shall be included in the labeling.
      Example: Panel HA
      Fed From MSB
      Located Main Elec. RM 100
      Example: Disconnect for Panel LK
      Location: Kitchen
      Fed From Transformer TLK
      Located Main Elec. RM 100
   c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
   d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel “HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100”)
   e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
   f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e., C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1	Receptacle Contactor C2

West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	

g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A

h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.

i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e., TLA.

j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example ATS-1	Wall Mounted Lighting ATS Example ATS
Emer Power-Emer Generator Located Chiller Yard Normal Power-MSB Located-Mech Rm 100 Serves Panel EHA Located-Mech Rm 100	Exterior Wall Packs/Soffit Lights North/West Metal Canopy Lights Fed from EHA-2 Located Mech Rm 200 Fed From HB-4 Located Mech Rm 150

k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.

l. Switchgear, switchboards, panelboards, motor control centers, or service equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record’s seal on the Construction Documents. Example:

AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY

3. 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 explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as “corridors”. Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect’s final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner’s motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.

B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location, mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.

E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer’s shop drawings for control wiring.

F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above

conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.

G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push-button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

3.2 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
1. Provide the training during regular working day.
2. The instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
3. Refer to other specification sections for additional training and commissioning requirements.

B. Time to be allocated for instructions.
1. Minimum of 48 hours dedicated instructor time.
2. 4 hours each campus, 2 hours on each of 2 days per campus. Time not used at one campus shall be distributed to other campuses as directed by the Owner.
3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
1. One copy to the Owner
2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.4 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.

B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.

C. Concrete pads:
1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
   1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
   2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
   3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer’s minimum circuit conductors, at no additional cost to the Owner.
   4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
   5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer’s maximum recommendations.

3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer’s recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.

B. Contractor shall adjust all overcurrent device settings based on manufacturer’s recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.

C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor

control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.

1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.

D. Information to be determined and applied to electrical equipment:
   1. Arc-Flash Protection Boundary
   2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 ™
   3. Working distance calculated in accordance with IEEE Std 1584a ™
   4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
      a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
   5. System phase-to-phase voltage
   6. Condition(s) when a shock hazard exists (e.g., “With cover off”)
   7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   10. Unique equipment designation or code (described under “Component Identification”
   11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
   12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
   13. Date that the hazard analysis was performed.
   14. “Served from” circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   15. If applicable, the “serves” circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a ™, paragraph 9.2.3.
   17. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.

E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

3.12 TESTING

A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.

B. The project will not be declared substantially complete until the following has taken place.
   1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
   2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
      a. Occupancy Sensor and Lighting Controls
      b. Surge protective device equipment
      c. Overcurrent devices
      d. Motor Controllers
      e. Emergency Lighting
      f. Building Fire Alarm System

3.13 LOAD BALANCING

A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, “Motor Tip Sheet #7” dated September 2005 available for download to PDF format at no charge at:
http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systemts7.pdf

END OF SECTION

SECTION 26 05 05
ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspection and service of existing equipment and materials to remain or be reused.

B. Handling of equipment and materials to be abandoned.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements and circuiting arrangements.

D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and

equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.

E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.

B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminarie that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures.

C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.

D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.

F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Panelboards Reused and Modified for Renovation: 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.

3.3 SEQUENCING AND SCHEDULING

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. 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.

C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before

partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.

D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.

E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
1. Remove exposed conduit that has been abandoned.
2. Cap conduit beyond the finish line.
3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.

F. Where new/existing luminaries or devices are shown being connected to existing circuits:
1. Field verify existing system voltage
2. Provide ballast / device to match system voltage

G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.

H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.

I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the following:
   a. Equipment is removed or relocated
   b. Fixtures are removed or relocated
   c. System is no longer used
   d. There is no demonstrable near-term future use for the existing circuit or raceway system.
2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
   a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
   b. Removal is not feasible due to hazards, construction methods, or restricted access.
   c. Removal of abandoned conductors may damage conductors that must remain operational.
3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.

4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.

B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.

D. Conduit 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's representative. Conduit 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

K. Existing conduit raceway found to need additional hangers installed and/or junction box

covers shall be added at no additional cost to the Owner.

L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description “existing”. Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.7 CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

A. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
   1. Notify the Owner immediately of any disruption or damage to any low voltage system.
   2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
   3. For each low voltage system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
   4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION

SECTION 26 05 10
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide manufacturer’s qualified personnel to observe:
   1. Field conditions
   2. Condition of installation
   3. Quality of workmanship
   4. Start-up of equipment
   5. Testing, adjusting, and balancing of equipment

B. Manufacturer’s qualified personnel shall make written report of observations and

recommendations to Architect / Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

B. Coordination Drawings:
1. Electrical room size and location required and to scale
2. Equipment and accessories, switchgear and piping
3. Indicate clearances and service access.

3.2 ELECTRICAL ACCEPTANCE TESTING

A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification* (ATS).

B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
1. Installed in accordance with design documents and manufacturer’s instructions.
2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
3. Ready to be energized.

4. Operational within industry and manufacturer's tolerances.

3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

3.4 MOCK-UPS

A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.

B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.

C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.

D. Mock up ten feet of cable tray including all supports, hardware and bonding.

END OF SECTION

SECTION 26 05 12
ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Provide individual submittals based on the project specification section number and description and only items specified or required in that specific project specification section.

C. Submit product data shop drawings only for the following items indicated below when included as part of the project specifications, and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review, typically for basic materials and commodity off-the-shelf materials, and/or to imply that materials shall be provided as specified without exception.

D. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

E. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, in the related O&M manual section.

1.2 ARCHITECT / ENGINEER REVIEW OF SUBMITTALS

A. The Architect / Engineer will:
1. Review requested submittals with reasonable promptness. Specific equipment submittal within a materials specification section that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
2. Affix stamp and initials or signature and indicate requirements for resubmittal or exceptions to submittal as submitted.
3. Return submittals to Contractor for distribution or for resubmission.

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes, or coordination with the work of other trades.

D. The review of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

A. Do not make requests for product or material substitution employing the procedures of this Section. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS

A. Each individual submittal shall be an individual specific electronic data file with the file name resembling the product specification section number and title. Refer to Division 01 for additional data file format and media requirements.

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

A. Do not submit an outline form of compliance, submit a complete copy with the product data.

B. Mark up a complete copy of the complete specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:).

C. Variances for roduct ot materials typically include updated model numbers or updated versions of the specified product from the same manufacture or an equal or better product from the approved manufactures list. Substutions from manufacture’s not on the approved manufacture’s will not be reviewed unless prior approval using one of the procedures for substitutions or changes in the contract documents are followed as requried in Division 01.

3.2 COMPOSITE COORDINATION DRAWINGS

A. Produce a set of composite coordination drawings for above ceiling, below ceiling, and below floor of electrical, mechanical, and technology equipment rooms and equipment yards for review and comment within four (4) weeks of receipt of Owner’s official Notice to Proceed. Show coordination of items including but not limited to structural and architectural elements, all mechanical and plumbing piping, ductwork, equipment, electrical conduit, low voltage communications and safety/security systems cabling, cable trays, lighting, electrical switchgear, generators and UPSs, and any public or private building utility services.
   1. Prepare the composite plans at one-quarter inch (1/4”) equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
   2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
   3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
   4. Identify field dimensions. Show relation to adjacent or critical features of work or products.

B. Submit composite coordination shop drawings in plan, elevation and sections, showing

receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.

1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
3. Submit coordination and shop drawings prior to rough-in and fabrication.

3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal. Do not submit entire product catalogs, submit only specific data sheets indicating required product information and available product options or accessories.

B. Submittal Specification Information:
1. Every submittal document shall bear the following information as used in the project manual:
   a. The related specification section number
   b. The exact specification section title
   c. Additional identifiers as required in Division 01.
2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been submitted or delivered.

C. All product options specified shall be clearly indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as either part of or not part of the product data submitted shall become part of the Contract and shall be assumed to be provided with the product submitted.

D. Mark each copy of standard manufacture’s printed data to identify pertinent products, referenced to specification section and article number.

E. Show reference standards, performance characteristics and capacities; wiring diagrams and controls; component parts; finishes; dimensions and required clearances.

F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete or strike through information not applicable.

G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.

I. Identify field dimensions; show relation to adjacent or critical features or work or products.

J. Submit individually bound shop drawings and product data for the following when specified or provided.

K. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other electrical switchgear dependent on the results of the study for specific product selection by the vendor or contractor for compliance with the study.
1. The emergency life safety power system equipment shall be fully coordinated as required by the NEC.

2. The AIC and WCR ratings of all products meet or exceed the available fault current at that equipment's location.
3. Electrical systems other than life safety power systems shall be coordinated as much as practicable while reducing arc flash energy as much as practical.

L. Required submittals when products are indicated or specified:
1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis at a minimum of three (3) weeks prior to any overcurrent device submittal to allow review for modifications to overcurrent device product selection submittal based on the manufacture's analysis and recommendations. Manufacture's recommendations for code compliance equipment fault tolerance are a project requirement and shall be provided at no additional cost to the Owner. Manufacture's recommendations for arc flash reduction that result in no additional cost to the Owner shall be provided. Manufacture's recommendations for arch flash reduction which would result in additional cost to the Owner are considered recommendations only and will be reviewed by the Engineer during the submittal review and may or may not result in changes to the specified or submitted equipment.
2. Enclosed Switches, non-fused, fused, or circuit breaker
3. Panelboards
4. Load centers
5. Wiring devices
6. Lighting fixtures
7. Lighting Controls
8. Surge Protection Devices
9. Transformers
10. Electrical Contactors
11. Enclosed Motor Controllers
12. Site Lighting Photometrics, Poles, and Fixtures
13. Switchboards, including renewal components for existing switchboards.
14. Elevator Power Module fused switches.
15. Fuses
16. Recessed floor boxes and fittings
17. Metering equipment for building management energy monitoring, usage, IECC compliance
18. Surface Raceways
19. Emergency/Standby generators
20. Automatic transfer switches
21. Manual transfer switches with or without integral generator docking stations
22. Remote generator docking stations
23. Emergency lighting inverters
24. Theatrical Lighting Systems
25. Architectural Dimming Systems
26. Electrical cable trays
22. Sports Lighting Equipment, Photometrics, Fixtures, and Poles

3.4 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

3.5 CONTRACTOR RESPONSIBILITIES

A. Review, make corrections or annotations for clarification of manufacturer supplied data, stamp and sign submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with the Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are required, until such submittals have been produced and bear contractor's stamp of acceptance or approval. Do not fabricate products or begin work until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors, omissions, or un-approved substitutions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service; manufacture’s and code required clearances.
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.

J. General and Electrical Contractor’s Stamp of Approval
   1. The general contractor and the electrical contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
   2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
   3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
   4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

3.6 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in,

foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.

B. Number of submittals required:
1. Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions or coordination drawings.
2. Product Data: Submit electronic data PDF files. Refer to Division 01 for specific requirements. PDF files that are 20MB or larger may indicate that a submittal includes information not specifically relevant to the specific product being provided, information not required for the review of the specific product such as a complete product catalog or catalog section. Contractor shall include only the product data required to review the specific products characteristics for compliance with the contract documents.

C. Accompany submittals with transmittal letter containing:
1. Date
2. Project title and number
3. Contractor's name, address and contact information.
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data as required in Division 01.

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval.

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

3.7 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any additional changes which have been made by the contractor other than those requested by the Architect / Engineer.

END OF SECTION

SECTION 26 05 19
CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical conductors, wire and connector work as shown, and specified.

B. Types: The types of conductors and connectors required for the project include the following:
1. 600V building conductors
2. 600V building conductor connectors

C. Application: The applications for conductors and connectors required on the project are as follows:
1. Power distribution circuitry
2. Lighting branch circuitry
3. Appliance, receptacle, and equipment branch circuitry
4. Motor branch circuitry
5. Control wiring
6. Line voltage

D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.

B. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

C. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.

D. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
1. All wiring inside lighting fixtures shall be temperature rated per NEC.
2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/ Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:
1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.

B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.

C. Conductors:
1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
4. When more than four (4) conductors are size #10 AWG, they shall be installed in

a one-inch conduit.

5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
9. Provide the same size wire form the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
    a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
    c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
    e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
    f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
12. Support conductors in vertical raceways, as required by the NEC.
13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
17. After a splice is made, insulate entire assembly with UL-approved insulating tape

to a value equivalent to the adjacent insulation.

18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
21. Clean conductor surfaces before installing lugs and connectors.
22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
24. Run mains and feeders their entire length in continuous pieces without splices or joints.
25. Color code conductors.
26. Do not install a pull string in conduits containing conductors.
27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.

D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.

E. Splices and Joints:
   1. In accordance with UL 486A, C, D, E, and NEC.
   2. Aboveground Circuits (No. 10 AWG and smaller):
      a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220˚ F, with integral insulation, approved for copper and aluminum conductors.
      b. The integral insulator shall have a skirt to completely cover the stripped wires.
      c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
   3. Motor connections:
      a. All AHU motors connections shall be split bolt connectors.
      b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
      c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.

F. Aboveground Circuits (No. 8 AWG and larger):
   1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
   2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
   3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
   4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

G. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190˚F, with integral insulation.

3.2 TESTING

A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.

1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.

C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.

D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date_____

Contract and Work Location: ___
Contract (Project) No.: _
Circuit Identification: ___
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)
Applied Test Voltage _____
Normal Oper. Voltage _____
Cable Installation: New _____ Used _____
(Date) (No. Years)
Cable Size _____AWG
Cable Length _____Ft.
Cable Material _____Cu _____Al
Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

SECTION 26 05 27
EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Grounding shall conform to the requirements of:
   1. National Electrical Code
   2. Governing local codes
   3. Local Utility Company

B. Ground effectively and permanently.
   1. Verify existing neutral conductor bonding at the main service disconnect and at other new/relocated or reused separately derived systems.
   2. All new/relocated conduit or cable tray systems and busway
   3. All new/relocated electrical equipment and related current carrying supports or structures
   4. All new / relocated metal piping systems
   5. All new building structural metal frames

1.2 REFERENCE STANDARDS

A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."

B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."

C. Article 250 of the NEC (NFPA 70) for grounding.

D. NECA – Standard of Installation

E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Copperweld

B. nVent ERICO

C. Burndy

D. O.Z. Gedney

E. Eaton

2.2 GROUNDING ELECTRODES

A. Driven Rod Electrode
   1. 3/4" x 10'-0" copper clad grounding electrode, UL listed
   2. UL listed grounding electrode connector

3. Approved thermal fusion methods (exothermic)

B. Metal Frame of Building

C. Existing grounding electrode system

2.3 DRIVEN ELECTRODE ACCESS BOX AND COVER

A. Hubbell Tier 22 FRP 20-inch round bolt down cover with “GROUND” embossed on top.

2.4 MATERIALS AND COMPONENTS

A. Reference other sections of this specifications for materials specified there.

B. Heavy-duty, copper, two bolt type, copper alloy or bronze compression lugs for grounding and bonding applications, in configurations required for particular installation.

PART 3 - EXECUTION

3.1 SYSTEMS 600 VOLTS OR LESS

A. In the existing service equipment, field verify existing condition of ground bus.
1. Field verify existing bond of the ground bus to the existing service grounding conductor, to the neutral bar.
2. Tighten existing ground lugs and connections.

B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
1. In rigid PVC conduit.
2. Provide thermo fusion connection for each rod ground electrode.
   a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
   b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
   c. The minimum distance between driven ground rod electrodes shall be 10'.
3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and for equipment grounds.
   a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
   b. Refer to drawings for project specific ground resistance requirements.

C. Field verify the grounding electrode conductor between the ground bus and the grounding electrode systems are in compliance with the NEC.

D. Provide an insulated grounding conductor inside all new conduits, raceways, surface raceways and cables used for power distribution. The ground wire shall be bonded to each box. All bonding jumpers shall be routed inside conduit or raceway.

E. Provide an insulated, isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and receptacles.

F. Provide all new/relocated conduits terminating in switchgear, transformers, switchboards,

and panelboards with grounding bushings, where required and ground wire extended to ground bus in equipment.

G. Where modifications to the main service disconnect are required, main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.

H. Interface with lightning protection system when lightning protection system is specified.

I. Locate and install anchors, fasteners, and supports in accordance with NECA “Standard of Installation”.

J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

K. Do not use spring steel clips and clamps.

L. Do not use powder-actuated anchors.

M. Do not drill or cut structural members.

N. Do not use compression or mechanical connectors underground.

3.2 MISCELLANEOUS REQUIREMENTS

A. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be inside conduit, fittings and boxes and shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.

B. Grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable PVC raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.

C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.

D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
   1. New MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico Cadweld #B544A028 ground bar with 7/16-inch holes, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the main electrical service disconnect.
   2. New IDF Closets Telecommunications Ground Bar (TGB): Provide Erico Cadweld #B542A004 ground bar with 7/16-inch holes, mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel.
   3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
   4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service

ground bus at main electrical service switch.

5. Bond each equipment rack with #6 AWG insulated ground conductor to the TMGB / TGB.
6. Route TMGB – TGB ground conductor using the shortest route practical with long radius curves.

E. Ground new and removed/replaced lighting fixture bodies to the conduit grounding system.

F. Receptacles: Provide a ground wire bonded to the conduit ground system, except where and insulated isolated grounding receptacle is specified.

G. Motor Frames: Ground the frame of each motor with a properly sized separate ground wire around flexible conduit.

H. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
1. Access well top shall be flush with finish paved surfaces.
2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
3. Provide thermal fusion (exothermic) connectors approved for direct burial.

I. Ground all light poles and all exterior metal structures supporting conduit, switchgear, or light fixtures.

J. Exterior Electrical Equipment Racks:
1. Provide driven ground electrode for racks mounted remote from building structure.
2. Where mounted on roof, ground to be building structural steel.

K. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).

L. Transformers: Provide driven ground electrode and building steel electrode at each transformer.

M. Bond hot water and cold water piping together at each domestic water heater.

3.4 COORDINATION

A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.5 TESTING

A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
1. Inspect and test in accordance with NETA ATS except Section 4
2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13

B. The Root Mean Square (RMS) AC measurements: The True RMS AC Measure test

should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.

C. Two-Point Bonding Measurements: The two-Point Bonding test shall be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms).

D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

SECTION 26 05 33
CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

A. National Electrical Code

B. Local codes and ordinances

C. UL

D. ETL

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

A. Raceways:
1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit, Sentinel Conduit.
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass, United Fiberglass

B. Fittings:
1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

C. Condulets and Conduit Bodies:
1. Appleton, Form 85
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

D. Steel MC Cable for light fixture whips:
1. AFC
2. Southwire

3. General Cable
4. Kaf-Tech

2.2 GENERAL

A. The minimum conduit size shall be ¾-inch unless indicated otherwise in Divisions 26, 27 or 28.
   1. Branch Circuits: Minimum conduit size shall be ¾-inch.
   2. Feeder Circuits: Minimum conduit size shall be ¾-inches.
   3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be ¾-inches unless noted or indicated otherwise.
   4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.

B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.

C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.

D. BX and AC cable shall not be used on this project.

E. PVC elbows shall not be used on this project.

F. Intermediate metal conduit (IMC) shall not be used on this project.

2.3 RIGID METAL CONDUIT

A. UL labeled, Schedule 40:
   1. Mild steel pipe, zinc coated inside and out
   2. Aluminum Alloy 6063, T-1 temper
   3. Threaded ends
   4. Insulated bushings

B. Fittings shall meet the same requirements as rigid metal conduits.
   1. UL labeled
   2. Threaded fittings

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. UL labeled, standard weight:
   1. Cold rolled steel tubing, zinc coated inside and out
   2. Aluminum Alloy 6005, 6063. Temper T-1

B. Fittings shall meet the same requirements as EMT conduits.
   1. UL labeled
   2. Insulated throat connectors
   3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
   4. Cast metal fittings are not approved
   5. Uni-couple type connectors are not approved
   6. Split ring, anti-short bushings are not approved

2.5 RTRC CONDUIT FITTINGS AND CONDUIT BODIES

A. UL listed

B. Standard wall thickness sizes ¼-inch through 4-inch

C. Underground medium wall thickness sizes 5 and 6-inch

D. Conduit interface joints above grade, gasket joint below grade

E. Extra heavy wall for above ground and/or UL Class 1 Division 2 and Class 1 Zone 2 applications.

2.6 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H_2O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.

C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.

D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.

E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.

F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.

G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.

H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).

J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.

K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
1. Conduit and condulet exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.

N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

2.7 STEEL FLEXIBLE CONDUIT

A. Steel flexible metallic conduit:
1. Zinc coated inside and out
2. 18-inches minimum length, 24-inches maximum length

B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
1. 18 inches minimum length; 6 feet maximum length

C. Liquid tight flexible steel conduit
1. Type L.A. - Grounded - UL Approved
2. 18-inches minimum length, 24-inches maximum length

2.8 PVC CONDUIT

A. UL labeled Schedule 40 and Schedule 80

B. PVC fittings and solvent welded joints

C. Acceptable PVC condulet manufacturer: Ipex, Cantex

2.9 CONDULETS AND CONDUIT BODIES

A. UL Labeled

B. Form 85

C. PVC Coated: Form 8

D. LBC Condulets shall be used for size 2 inch and above.

E. LL and LR Condulets shall not be used for 2 inch and above

2.10 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.

B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.

C. Approved Manufacturer:
1. Portable Pipe Hangers
2. Eaton B-Line
3. Miro Industries, Inc.

2.11 ALUMINUM CONDUIT

A. UL Labeled

B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
1. UL Labeled for use with aluminum conduit.

2.12 STAINLESS STEEL CONDUIT

A. UL Labeled

B. Rigid Stainless Steel:
1. Type 304 Stainless Steel
2. Threaded ends
3. Insulated Bushings

C. EMT:
1. Type 304 Stainless Steel
2. Compression Fittings
3. Insulated Bushings

D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
1. Type 304 Stainless Steel

2.13 ELECTRICAL NON-METALLIC TUBING (ENT)

A. UL labeled Schedule 40

B. PVC fittings and solvent welded joints

C. Acceptable manufacture: Carlon

2.14 EXTERIOR IN-GRADE PULL BOXES

A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.

2. Conduit entry knock-outs as required
3. Bolt down galvanized steel/cast iron covers
4. Thin wall knocks outs as required
4. Integral bottom
5. Box height as required for specified conduit depth and required top elevation.
6. Concrete design strength of minimum 5,500 PSI at 28-days
7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
8. Size and volume as required for application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA “Standard of Installation”, concealed where possible.
1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
2. Arrange supports to prevent misalignment during wiring installation.
3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
4. Do not attach conduit to ceiling support wires.
5. Arrange conduit to maintain head room and present neat appearance.
6. Maintain 4-inch clearance between conduit and rooftop surfaces.
7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
8. Bring conduit to shoulder of fittings; fasten securely.
9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
11. Ground and bond conduit as required.
12. Identify conduit as required.
13. Route all conduits above building slab perpendicular or parallel to building lines.
14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.

B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.

D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.

E. Provide separate raceway systems for each of the following when specified, indicated or required:
1. 120/208 volt circuits

2. 277/480 volt circuits
3. Emergency
   a. Life safety branch
   b. Critical branch
   c. Equipment branch
4. Voice/Data
5. Sound reinforcement
6. Theatrical and Architectural Dimming Controls
7. MATV/CATV
8. Security CCTV
9. Security System
10. Communications / PA Systems / Sound System Line Input and Speakers
11. Fire Alarm
12. Lighting Control Systems
13. Building Management Control Systems

F. Unless shown otherwise, do not install conduit in or below concrete building slabs.

G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.

H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.

I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer’s approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.

J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer’s Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer’s representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer’s representative shall certify the installation is in accordance with manufacturer’s installation instructions. Submit copies of installation certification prior to cover-up of underground installation.

K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
2. Provide insulated bushing on all rigid conduit terminations.
3. Provide locknuts inside and outside of all boxes and enclosures.
4. Provide threaded type plastic bushing at all boxes and enclosures

L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
2. Do not support from metal roof deck.

M. Completely install each conduit run prior to pulling conductors. All boxes are to be accessible after completion of construction.

N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.

O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.

P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
   1. Cable Tension:
      a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
      b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
      c. 1000 lbs. per basket grip.
   2. Sidewall pressure: 500 lbs./ft.
   3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
      a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
      b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.
      c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
      d. Straight pull: not more than two hundred feet (200') between pull points.
   4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
   5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
   6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
   7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
   8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
   9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
   10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.

Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.

R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.

S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.

T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.

U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.

V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.

W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt "wings" are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with "Tee" conduit at motor outlet height for flexible conduit.

Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.

Z. Where "LB" condulets are used, 2-inches and larger shall be type "LBD".

AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.

BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc. They are not to be used in lieu of conduit runs. They shall not be used for wall or roof penetrations unless they are installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.

CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.

DD. “Daisy Chaining” light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.

EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.

FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.

GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

3.2 CONDUITS

A. Conduit above grade indoors:
1. Concealed Conduits: EMT with set screw fittings
2. Exposed conduits:
a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit or x-wall RTRC.
b. Where subject to physical damage: Rigid metal conduit or x-wall RTRC.
c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
d. Damp Locations: Aluminum rigid conduit or x-wall RTRC.
e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel or x-wall RTRC when installed below 18-inches above finished floor.

B. Conduit installed above grade outdoors:
1. Galvanized rigid steel or x-wall RTRC for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
2. Aluminum or x-wall RTRC where not subject to physical damage and where located four feet above finished floor.

C. Conduit where indicated underground:
1. PVC Coated Galvanized rigid steel or RTRC conduit elbows and Schedule 80 PVC, RTRC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
a. PVC conduit and fittings shall be used only for straight horizontal runs and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.
b. Change in direction of conduit runs, either vertical or horizontal, shall be with RTRC or PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.

c. Provide RTRC or PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous RTRC or PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.

d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be RTRC or PVC coated rigid galvanized steel with long radius as follows:
   1) Up to 1-inch conduit, minimum 12-inch radius.
   2) 1.5-inch conduit, minimum 18-inch radius.
   3) 2-inch conduit, minimum 24-inch radius.
   4) 2.5-inch conduit, minimum 30-inch radius.
   5) 3-inch conduit, minimum 36-inch radius.
   6) 3.5 to 6-inch conduit, minimum 48-inch radius.

e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.

f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.

2. Encase all underground conduits in concrete.
   a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
   b. Provide minimum 3-inch concrete encasement around conduits.
   c. Provide conduit spacers for parallel branch/feeder conduits.
   d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
   e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.
4. Provide two “caution” plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.

5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.

D. Conduit shown in concrete walls, floor or roof slab:
   1. PVC Coated Galvanized Rigid steel.

E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
   1. RTRC
   2. PVC coated galvanized rigid steel

F. Connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
   1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
   2. Liquid tight flexible metal conduit for 24-inch maximum length
   3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.

G. Light fixture whips:
   1. Accessible ceilings and open structure: ½-inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.
   2. Non-accessible ceilings: ½-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture’s integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
   3. Dedicated insulated ground wire.
   4. Light fixture whips shall not rest on ceiling grid or tile.
   5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.

H. Conduits at Natatorium or therapeutic pool areas:

1. Underground conduit shall be as specified in this section.
2. Exterior conduits and boxes within 100 feet of exhaust openings shall be x-wall RTRC or PVC coated galvanized rigid steel or stainless steel.
3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.

I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
1. X-wall RTRC
2. Schedule 80 PVC
3. PVC coated galvanized rigid steel conduit and fittings.

J. Conduits in classified hazardous (Classified) locations:
1. Conduit fittings and seals UL listed for the classification

K. Conduits embedded in parking structure traffic wearing surface and concrete support structures:
1. Schedule 40 PVC, RTRC, PVC coated rigid galvanized conduit.
2. Schedule 40 ENT may only be used for flat runs embedded in traffic wearing surface concrete topping.
2. Solvent welded fittings only for PVC conduit and ENT.
3. Verify with Structural Engineer prior to construction for any additional limitations for raceway installation restrictions installed in parking structure including but not limited to maximum outside diameter of raceways permitted to be used in the wearing surface, and field cutting or drilling through parking structure structural members or support structures.
4. All raceways shall be securely fastened to prevent floating during concrete installation. ENT raceways shall be completely embedded in concrete material to maintain fire and smoke integratory as required by the NEC.
5. When using ENT or PVC conduits, provide transition to x-wall RTRC or PVC coated rigid galvanized conduit elbows and vertical risers to ensure that only flat horizontal runs of PVC conduit or ENT are used along the top of the parking structure structural support deck and that they are completely concealed and embedded by the wearing surface concrete material topping.

3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
2. Sleeves shall extend 3-inches above the finished floor.

B. Sleeves in concrete or masonry walls shall be RTRC or Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.

C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.

D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low

voltage cabling conduit penetrations with waterproof caulking.

E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.

F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.

G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

A. Power underground feeder and service entrance shall be of individual conduit encased in concrete. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. The concrete encasement surrounding the underground conduit shall be rectangular in cross-section, having a minimum concrete thickness of 3-inches, except that conduit for 120V and above shall be separated from control and signal conduits by a minimum concrete thickness of 3-inches. Encasement concrete shall be tinted in red.

B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.

C. Furnish the exact dimensions and location of power underground conduit to be encased in time to prevent delay in the concrete work.

D. Conduit for service entrance underground conduits shall be as indicated on the drawings.

E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.

B. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above

accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.

1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
   a. Non-masonry outlet box: Two 1-inch conduits.
   b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
   c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.

C. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.

D. Conduits for Building Entrance Facilities:
1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

3.6 EXTERIOR IN-GRADE PULL BOXES

A. Provide pull boxes where specified and as required.

B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.

C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.7 IDENTIFICATION

A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power

(120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, 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 spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

SECTION 26 05 35
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.

B. Raceways: Refer to related sections.

C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.

D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.

B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.

C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.

D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.

E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.

F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable condulet, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.

G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:
1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
2. Where conduit originates from an elevation above the conduit entry, provide a “T” condulet below the enclosure’s bottom elevation. Provide conduit from the condulet up to the enclosure bottom horizontal surface for electrical connection.

H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.

I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.

J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

SECTION 26 05 37
ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.

1. Type of Various Locations:
   a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
   b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
   c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
   d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
   e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
   f. Surface: Type FS or FD box with surface cover.
   g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
   h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
   i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.

B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate

with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.

C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.

D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
   1. Type for Various Locations:
      a. Minimum Size: 4-inch square, 2-1/8-inches deep.
      b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
      c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners

E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.

F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.

G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.

B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.

C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.

D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light

fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.

E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.

F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.

H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.

I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.

J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.

K. Provide knockout closures to cap unused knockout holes in boxes.

L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.

M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.

N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.

O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.

P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.

Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.

R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
1. Green: - HVAC system power

2. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
3. Light Blue - 120/208/240 VAC systems
4. Yellow – Lighting Systems
5. White (Verify with Division 27) - Security and Surveillance equipment circuits

S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example “MSB to Panel HA”). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example “LA2” referring to Panel LA sec. 2 is to be listed as “LA”). Label covers for special applications explaining contents (example “Emerg. Gen. Annunciator controls”, “IDF ground”). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example “Not Used Panel LA”. Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.

T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.

V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.

X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.

Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.

AA. Use adjustable steel channel fasteners for hung ceiling outlet box.

BB. Do not fasten boxes to ceiling support wires.

CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.

DD. Use gang box where more than one device is mounted together. Do not use sectional box.

EE. Use gang box with plaster ring for single device outlets.

FF. Support outlets flush with suspended ceilings to the building structure.

GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.

HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.

II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.

JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.

KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.

LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.

MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.

NN. Bond equipment grounding conductor to all junction and pull boxes.

OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.

PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.

QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

END OF SECTION

SECTION 26 05 40
ELECTRICAL GUTTERS AND WIREWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical gutter work as shown, as specified and as required.

B. Application: The types of electrical gutters required for the project include the following:
   1. Electrical wiring gutters
   2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.

B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer’s standard lengths, without field cutting or field extensions.

C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.

D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.

E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.

B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.

C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to

installation of electrical gutters.

D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical conductivity. Provide equipment grounding conductor.

E. Conductors:
   1. Complete gutter and wireway installation before starting the installation of conductors.
   2. Provide sufficient space to permit access for installing, splicing, and maintaining the conductors.

F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any gutter or wireway.

END OF SECTION

SECTION 26 05 50
FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson

B. 3M (Minnesota Mining Manufacturing)

C. Hilti

D. Specified Technologies, Inc.

E. Metacaulk

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 26 09 25
ELECTRICAL CONTACTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric
Siemens

2.2 CONTACTORS

A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
2. Contacts shall be readily replaceable, self-aligning, silver alloy.
3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.

B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
3. Normally open contactors shall be spring-loaded open and magnetically closed.
4. Contactors for emergency lighting or power shall be normally closed.

C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.

D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.

E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses,

and in other corrosive areas shall be NEMA 4X, stainless steel.

F. Minimum interrupting rating shall be 35KAIC.

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer's recommendations.

B. Fuses: Install fuses where coil control power is fed from line side of contactor.

C. Adjustment: Adjust operating mechanisms for free mechanical movement.

D. Coordinate contactor control and operation requirements with the Building Management Control System.

E. Identify each contactor as specified in Section 26 05 00.

F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.

B. Provide mechanically held contactors where control is three-wire, momentary control signal.

C. Provide electrically held contactors where control is two-wire, constant control signal for open or close.

D. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.

E. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.

F. Provide control contactors and cabling for bi-level or tri-level LED drivers. Bi / tri level control contactors for exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings. Bi / tri level controls for interior lighting shall be controlled by occupancy sensors and local control switch.

END OF SECTION

SECTION 26 09 43
LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Lighting control system and components:
   1. Touch panel controls
   2. Lighting management panels
   3. Lighting management modules
   4. Low voltage wall stations
   5. Power interfaces
   6. Wired sensors
   7. Stand-alone room based architecture. Provide hardware capable of system network architecture without network connectivity or network interface hardware.

1.2 SUMMARY

A. The lighting control system specified in this section shall provide, sensor-based (both occupancy and daylight), and manual lighting control, and time based control when configured as a networked system.

B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed). Specific dimmers shall be capable of “dimming lights to off”.

C. All system devices within a group or controlled area shall be networked together, enabling digital communication between devices.

D. The system architecture shall be capable of enabling stand-alone groups (areas) of devices. If the system is networked together the groups or areas shall continue to function in a default capacity, even if network connectivity to the greater system is lost.

E. The system architecture shall facilitate remote operation via a computer connection when the system is networked together.

F. The system shall not require any centrally hardwired switching equipment.

G. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

H. The term “occupancy sensor” shall be interchangeable with the term “vacancy sensor” as the control hardware shall be the same device, and be capable of either function.

1.3 SUBMITTALS

A. Specification line-by-line compliance review consisting of a marked-up copy of these specifications with contractor comments. Refer to Submittals specification section for additional instructions.

B. Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring details, nomenclature)

C. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)

D. Other Diagrams – as needed for special operation or interaction with other system(s)

E. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up and commissioning.

F. Hardware and Software Operation Manuals

G. Other operational descriptions as needed

1.4 PROJECT CLOSEOUT DOCUMENTATION

A. Provide a factory published manual
   1. Warranty
   2. Technical support contact
   3. Electronic manual on manufacturer's website for free download

B. Completed Startup/Commissioning Worksheet with Owner's acceptance and date clearly noted.

1.5 QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in North America; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

B. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.6 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:
   1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C)
   2. Relative Humidity less than 90% non-condensing

B. Standard electrical enclosures shall be permanently installed

C. Equipment shall be protected from dust, debris and moisture

1.7 WARRANTY

A. Five (5) year manufacturer's warranty parts replacement beginning upon completion of Factory Start-up and Commissioning date as noted on the Owner accepted Startup / Commissioning Worksheet.

1.8 MAINTENANCE & SUSTAINABILITY

A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years available to the end user

B. Provide free telephone technical support

C. Spare Parts: Provide minimum of 1 unit up to 5% of each hardware device product used, whichever is greater.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Acuity Brands Lighting, Inc. - System: nLight
2. Cooper Lighting Solutions: Greengate
3. Lutron – Athena
4. ILC – Intelligent Lighting Controls

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network capable backbone for remote or time based system operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, UL 924 emergency lighting relays, dimming outputs, manual switch stations, manual dimming stations. Combining one or more of these components into a single device enclosure is be permissible so as to minimize overall device count of system.

C. System may interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches, refer to Networked LED Luminaire section below.

D. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

E. Devices within a lighting control zone shall be connected with low voltage cabling in any order.

F. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

G. When Network architecture is implemented, individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

H. Power for devices within a lighting control zone shall come from either resident devices already present for that zone, controls enabled luminaires, or from the network backbone. Standalone “bus power supplies” are not acceptable.

I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications may require remote switching and shall be capable of being networked into the system.

J. Networked systems shall have one or more primary network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

K. Networked Systems may use a network bridge device to route communication and distribute power to directly connect lighting zones together for purposes of decreasing system wiring requirements.

L. Network system communications shall be hard wired. When systems devices are capable of WiFi, they shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the network bridge devices and all cabling that connects zones to bridge devices. Use of WiFi shall only be enabled with written permission and documentation from the Owner.

M. Networked systems shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control schedules and profiles.

N. Individual lighting zones shall be capable of being segmented into several local channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

O. Devices located in different lighting zones shall be able to communicate occupancy, photocell (non-dimming), and switch information via either the wired or WiFi backbone.

P. Networked systems shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a space's sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week, utilization of a space.

Q. Operating modes shall be utilized only in manners consistent with local energy codes.
1. Auto-On / Auto-Off (via occupancy sensors)
    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
2. Manual-On / Auto-Off (also called Semi-Automatic)
    a. Pushing a switch will turn lights on.
    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
3. Auto On / Predictive Off
    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    c. Pressing the switch will turn the lights off and a short "exit timer" begins. After the timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
4. Manual-On to Auto-On/Auto-Off
    a. Pushing a switch will turn lights on.
    b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Occupancy sensors (network capable):
1. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Only passive infrared (PIR) technology, which detects occupant motion, shall be used to initially turn lights on from an off state, thus preventing false on conditions.

3. Dual technology sensors shall be used. Only where ultrasonic or microphonic technology might create a false occupied state, not allowing the lights to automatically turn off shall PIR only be used. Acceptable dual technology includes PIR/Microphonics technology (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants or PIR/Ultrasonic technology.
4. Sensors shall include one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only) for BAS/BMCS control.
5. Sensors shall be available in multiple lens options which are customized for specific applications.
6. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate of a potential wiring issue
7. Every sensor parameter shall be available and configurable remotely from the software (when networked) and locally via the device push-button.
8. System shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
9. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection. Embedded sensors shall have an optional photocell
10. Ceiling, fixture, recessed, & corner mounted sensors shall be available.
11. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
12. Sensors shall be the following nLight model numbers, with device options as specified:

C. Daylight (photocell and/or dimming) sensors:
1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor’s set-point and deadband shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
5. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an “offset” from the primary zone.
6. Luminaire mounted dimming photocells shall be embedded into luminaire such that only the lens shows on luminaire face.

D. Power (Relay) Packs:
1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system.
2. Power Packs shall accept 120 or 277 VAC, rated for a minimum 16 Amps for any type of lighting load or motor load rated to 1 HP, provide 0-10 VDC dimming control, be plenum rated, and provide Class 2 power to the system.
3. Every Power Pack parameter shall be available and configurable remotely from the software (if networked) and locally via the device push-button.
4. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control

Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

5. When required by local code, Power Pack shall install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
6. Secondary Packs shall be available that provide up to 5 Amps of switching and can line voltage dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
7. Secondary Packs shall be available that provide up to 5 Amps of switching and can dim line voltage 120/277 VAC magnetic low voltage transformers.
8. Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
9. Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits and control of 0-10 VDC dimming circuit.
10. Secondary Packs shall be available that control louver/damper motors for skylights.
11. Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
12. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.

E. Relay & Dimming Panels:
1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
3. Panel shall provide one 0-10VDC dimming output paired with each relay.
4. Panel shall power itself from an integrated 120/277 VAC supply.
5. Panel shall be capable of operating as either two networked devices or as one.
6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection.

F. Networked Auxiliary Input / Output (I/O) Devices:
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.
2. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
4. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
5. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.
6. Specific I/O devices shall sense state of low voltage outdoor photocells.
7. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
8. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

G. Low Voltage Wall Switches & Dimmers:
1. All devices shall provide toggle on/off switch control.
2. Devices color shall match building standard line voltage wiring device color.
3. Devices with mechanical push-buttons shall provide tactile with LED user feedback.

4. Devices with mechanical push-buttons shall be made available with custom button labeling
5. Devices with a single “on” button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

H. Graphic Wall Station:
1. Minimum 3.5-inch full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
2. Color shall match building standard for line voltage switching.
3. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
4. Device shall enable user supplied .jpg screen saver image to be uploaded.
5. Surface mount to single-gang recessed switch box.
6. Micro-USB style connector for local computer connectivity.

I. Scene Controllers:
1. Two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Color shall match building standard for line voltage switching.
3. Devices shall provide LED user feedback.
4. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
5. When networked, the device shall be capable of selecting a lighting profile be run by the system’s upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
6. Device shall have LEDs indicating current selection.

2.4 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide the quantity of sensors required for complete and proper coverage to completely cover the controlled areas. Contractor shall verify room coverage and ceiling heights with manufacturer and provide the quantity and type of occupancy sensors as required. Rooms shall have one hundred (100) percent coverage of small motion detection to completely cover the controlled areas to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components, architectural components, or Owner installed equipment which may cause obstructions to sensor coverage.

C. Label each controller with 120/277 Volt circuit (i.e. “HD-27) and room graphic name and number. Do not use architectural room name or number on drawings, use room graphic identification only.

C. Provide ceiling mounted sensors. Wall mounted sensors shall only be used where ceiling mounted sensors are proven by the manufacturer to be impractical.

D. For ceilings up to 12-feet AFF, control equipment shall be mounted Above ceiling control equipment shall be wall mounted above an accessible ceiling on 24x24-inch fire resistive 0.75-inch thick plywood back board mounted to the wall above the ceiling, directly above the space/area main entry wall switch station, observing good installation practice and shall be consistent throughout the project. Where the ceiling is over 12-feet, the control equipment shall be located in an adjoining ancillary room/area where the ceiling is 12-feet AFF or lower, typically adjacent to the ancillary room/area above ceiling control equipment location.

E. Control units used for the security or fire systems shall be powered from the emergency power source as indicated on the drawings. Other control units shall be powered from the lighting circuit, which they control.

3.2 INSTALLATION

A. When using wire for connections other than Cat 5e with RJ-45 connectors, provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices.

B. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

C. The installing electrical contractor shall complete, prior to request of factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed, and confirmed operational.

D. The installing contractor shall, prior to request of factory start up and site commissioning, request an on-site meeting by including the manufacture’s local authorized representative, the Owner and the general contractor, to assist in identification of any open ended issues, thereby eliminating potential for delays and system commission interruptions.

E. Upon confirmation of progress by local factory representative, the installing electrical contractor shall complete the manufacture’s start up request form(s), including any field changes from the contract documents.

F. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning to the manufacturer’s representative. Drawing shall include all wire routing, room by room device ID’s and locations of all lighting control devices.

G. Install sensors in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

H. Install sensors and switches only in electrical boxes that are clean, free from excess building materials, debris, and similar matter.

I. Install sensors plumb and aligned in the plane of the wall, floor, or ceiling in where they are installed.

J. Install wall occupancy sensor switches in boxes on the strike side of doors as hung. Install a uniform position so the same direction will open and close the circuit throughout the project. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.

K. Provide a cover plate for every switch. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.

L. Refer to Architectural drawing, elevations, etc. for exact location of wall switches where indicated on the Architectural plans. Coordinate location of all wall switches with other specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts during construction. Mounting heights of all switches shall comply with current Accessibility Standards and local codes.

M. Unless indicated otherwise, circuit relays/switchpacks ahead of local control switches. Source –> relay/switchpack –> local toggle switch(s).

N. Coordinate with BMCS/BAS Contractor for interface of BMCS/BAS System and wiring connections.

3.3 SENSOR TESTING AND ADJUSTMENT

A. At the time of installation the contractor shall test and adjust each sensor for proper detection of motion appropriate to room usage. The contractor shall follow the testing and adjustment procedures as written in the manufacturer’s installation instructions for each sensor model.

B. Prior to testing and adjusting, verify with Owner/Architect the initial settings for each type of area based on its intended function and use.

C. Verify with Owner all adjustable functions of each type of occupancy sensor prior to installation. Set all adjustable functions of each type of occupancy sensor as directed by Owner. Initial settings unless directed by Owner / Architect:
1. Time delay = maximum
2. Zero Time Delay = Off
3. Auto-On = On (Occupancy) Auto = OFF (Vacancy)
4. Manual-On = Off
5. Self-Adjust = Off
6. Disable Self-Adjust = On
7. Energy Saver (Dual Level) = On
8. Manual Override = Off

D. Bi-level occupancy wall switches shall be initially set with the energy saver feature enabled.

E. Before energizing, check for continuity of circuits, short circuits, and grounding connections. After energizing, check devices to demonstrate proper operation.

F. Operate each wall switch with circuit energized and verify proper operation.

3.4 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The factory commissioning shall include the following services. Programming of all button stations, configuration and of all occupancy sensors and photocells.

C. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting set points.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters

D. The electrical contractor shall provide in writing to the manufacturer, General Contractor, Architect, and the Owner with 21 Owner’s business days’ written notice of the requested system startup and adjustment date.

E. The electrical contractor shall provide at least (1) journeyman electrician familiar with the installation of the system dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

F. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the Owner's personnel on the adjustment and maintenance of the system.

G. Re-commissioning – After 90 days from certificate of occupancy, 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 12 17

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS (EXCEEDS DOE 2016 EFFICIENCY)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
   1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.

B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards

B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.

C. Metering Standards:
   1. Computational algorithms per IEEE Std 1459-2000
   2. UL 916, UL 61010C-1 CAT III

D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
   1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.

E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.

F. ISO 9000:2000 – International Standards Organization - Quality Management System

G. ISO 14000:2004 – International Standards Organization - Environmental Management System

H. NFPA 70 - National Electrical Code (Latest Edition)

I. NEMA ST20-2014 - Dry-Type Transformers for General Applications

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment

K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.

L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.

M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.

N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. Submit product data including the following:
1. Copy of ISO 14001:2004 Certification of manufacturing operation.
2. Copy of ISO 9001:2000 Certification of manufacturing operation.
3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
5. Inrush Current (typical 3 cycle recovery)
6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
7. Efficiency Data
   a. No load and full load losses per NEMA ST20
   b. Linear load Efficiency data @ 1/6 load
   c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
   d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
   e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
   a. Meter and CT details including model, accuracy, serial numbers and calibration information.
9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
10. 25 year Product Warranty Certificate

B. Description of manufacturer’s factory nonlinear load test program.
1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.

6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

1.4 SPECIFICATION COMPLIANCE REVIEW

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store and protect products

B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.

C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

1.6 WARRANTY

A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

A. Registration to current ISO standard is required.

B. Independent annual audits are conducted.

C. Product shall be manufactured in registered facility

D. ISO 9001:2000 Registered – Quality Management System

E. ISO 14001:2004 Registered – Environmental Management System
1. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must the product of a manufacturing process that has been independently audited to comply with the ISO 14001:2004 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.
2. ISO 14001:2004 ensures that a facility has had an independent environmental impact assessment of raw material sourcing and all manufacturing processes, and has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

A. Powersmiths E-Saver OPAL

B. Power Quality International (Z3 e-Rated)

C. Mirus - ULLTRA

2.2 TRANSFORMER SPECIFICATION

A. Minimum UL Listed and Labeled K-Rating: [K7]

B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.

C. Insulation System:
1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest environmental impact, long term reliability and long life expectancy
   a. Class: 220 degrees C
   b. Impregnate Properties for low emissions during manufacturing, highest reliability and life expectancy
   c. Epoxy co-polymer
   d. VOC: less than 1.65 lbs./gal (low emissions during manufacturing)
   e. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
   f. Chemical Resistance: Must have documented excellent performance rating by supplier
   g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)
   h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life

D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient

E. Noise levels:
1. 3dB Below NEMA ST-20
2. Production Test every unit. Data to be available upon request.

F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431, April 18, 2013, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers: Final Rule which takes effect January 1, 2016, and comply with the table of maximum no Load Loses, efficiency requirements at 1/6 load, efficiency at 35% load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-rating load profile.

G. Maximum losses and minimum efficiency under linear load conditions per Table 1.

Table 1
Max and Min Values for Losses and Efficiency for "High Efficiency" Transformers
Under K1 Linear and Specified K-Rating Nonlinear Loading

kVA Rating	No Load	16.5% Load				25% Load				35% Load			
		K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
	Max Loss (kW)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.

I. Impedance: Between 3.0% and 6.0% unless otherwise noted.

J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise

K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors. Provide manufacturer's standard paint finish color indoors.

L. Transformer Options:
1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield

M. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:
1. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap

transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.

B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.

C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.

D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.

E. Check for damage and loose connections.

F. Set the transformer plumb and level.

G. Provide Seismic restraints where required.

H. Coordinate all work in this Section with that in other sections.

I. Verify all dimensions in the field.

J. Adjust transformer secondary voltages to provide the required voltage at the loads.

3.2 TESTING

A. Insulation Tests: Before energizing, check transformer windings for continuity.

B. Winding Current: During initial no-load energizing, check current in each primary winding.

C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings.

D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.

E. Performance Validation: To ensure that the products shipped to the job site meet this

specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.

F. Identify non-compliant products to the engineer and replace at no cost to the Owner.

G. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION

SECTION 26 19 13
COMBINATION MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Motor controller work as required, scheduled and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

2.2 MOTOR CONTROLLERS

A. General: Combination motor controllers shall consist of an integrally mounted, thermal magnetic or magnetic only circuit breaker disconnect or fused disconnect switch as specified in Section 26 24 25. Magnetic, full voltage non-reversing (FVNR) or two speed controller as required, in a heavy duty type, dead front enclosure, surface-mounted; size and number of poles as required. Controllers shall be constructed and tested in accordance with NEMA Standards. Refer to Division 23 for Variable Frequency Inverter furnished by Division 23, installed by Division 26. Minimum controller size shall be NEMA Size 1.

B. Contacts: Magnetic controller contacts shall be silver alloy, and not require any filing, dressing, or cleaning for the life of the controller.

C. Operating Coils: Operating coils shall be 120V, pressure molded and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. Design controller so that when a coil fails due to over voltage, the controller shall open, and not freeze in the closed position.

D. Overload Relays: Controllers shall have manual-reset, trip-free, solid state, overload relays in each phase conductor. Three phase FVNR controllers shall have three overload relays. Single-phase FVNR controllers shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic controllers shall have overload relays for all six ungrounded conductors. Overload relays shall not be field-convertible from manual to automatic reset. Provide reset button located in front cover to reset all overload relays.

E. LED Pilot Lights: Provide 30.5mm run and stop pilot lights for all motor controllers. Furnish additional pilot lights for motor controllers as shown. Provide FAST and SLOW pilot lights for two-speed controllers. Pilot lights shall be mounted in the controller enclosure cover. Pilot lights shall be operated from an interlock on the motor controllers, and not be wired across the operating coil.
   Green - Stop
   Red - Run
   Yellow - Slow
   Blue - Fast

F. Controls: Controllers shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed

controllers. Two-speed controllers shall have deceleration relays between fast and slow speeds. Coordinate motor controller controls with the requirements of Division 23. Motor controller controls shall be mounted in the controller enclosure cover. Control switches shall be un-keyed rotary switches.

G. Control Power: A single phase control power transformer shall be included with each controller for 120V control power. The primary shall be connected to the line side of the motor controller through two fuses; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals is not located above the transformer.

H. Auxiliary Contacts: Each controller shall have two normally open and two normally closed nonconvertible auxiliary contact in addition to the number of contacts required for the holding interlock and control wiring. One or more additional auxiliary contacts can be field installed without removing existing wiring, or removing the controller from its enclosure.

I. Phase Failure Monitors: Provide a 3-phase failure monitor for each motor controller. Monitor on any or all phases, for phase reversal from A-B-C sequence, under/over voltage, and phase failure. Provide adjustable relay for trip range. Provide automatic reset upon restoration of power to all phases. Where solid state overload relays provide this specified requirement, separate phase failure relays may be omitted.

J. Unit Wiring: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for: connection of power supply conductors to switch line side terminals; motor leads to the controller load side terminals; and control conductors to holding coil terminals.

K. Enclosure:
1. Motor Controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
2. Motor Controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

L. Minimum interrupting rating shall be 35KAIC.

2.3 MANUAL MOTOR CONTROLLERS

A. General: Manual motor controllers shall consist of an integral controller and overload protection in a common enclosure, surface mounted. Size and number of poles shall be as shown and required with pilot light.

B. Manual Motor Controller: Manual motor controller with overload protection, 1 HP maximum, 115 or 230V.

C. Enclosures:
1. Manual motor controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
2. Manual motor controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

D. Disconnect Switch: For self-protected motors where one pole toggle motor control switch is allowed, the switch shall be horsepower rated and as specified for toggle switches in Section 26 27 73.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR CONTROLLERS

A. General: Install combination motor controllers where required or indicated and in accordance with the manufacturer's written instructions, requirements of the NEC and NECA Standard of Installation, and industry practices. Do not install motor controllers above ceilings. Do not install motor controllers on roofs.

B. Overloads: Install overload relays with manual reset in each phase of motor controller. Overload adjustable settings shall be based on actual motor nameplate full load amps. Field verify nameplate full load amps and adjust all relay settings accordingly.
1. Set overcurrent at motor service factor x motor nameplate FLA
2. Set high voltage trip to 8.3 percent above nominal voltage
3. Set undercurrent trip to four automatic restarts
4. Set all other trips to zero auto restarts
5. Phase Failure Relay: Adjust phase failure relay to 10 percent over voltage and 10 percent under voltage.

C. Coordination: Motor controllers shall be provided to coordinate with motors furnished by Division 23. Motor controller controls shall be provided to coordinate with controls specified in Division 23.

D. Supports: Provide individual and combination motor controllers with galvanized angle or other suitable supports if mounting on wall or other rigid surface is impractical. Controllers shall not be supported by conduit alone. Where motor controllers are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas. Manual motor controllers shall be installed plumb and aligned in the plane of the wall where they are installed.

E. Identify each motor controller as specified in Section 26 05 00.

F. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.

3.2 TESTING

A. Provide the field services of the manufacturer to provide initial programming of all variable functions, start-up and commissioning of each motor controller.

B. Pre-Energization Check: Check motor controllers for continuous circuits and short circuits.

C. Post Hook-Up Test: After wire and cable hook-ups, energize motor controller to show it functions as specified.

D. Provide thermal infrared scan of the combination motor controllers rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 24 16
PANELBOARDS AND ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

1.3 SUBMITTALS

A. Indicate:
1. Detailed dimensions.
2. Enclosure material, finish, and NEMA classification type.
3. Location of main circuit breaker.
4. Mounting and trim.
5. Acceptable incoming conductors' size.
6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

2.2 MATERIALS AND COMPONENTS

A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards

shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.

D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
5. General requirements:
   a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
   b. Two and three pole breakers shall have internal common trips.
   c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
   d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
   e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
   f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
   g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
   h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).

E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.

F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.

G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short

circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.

H. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED”.

I. Panelboard Enclosures:
1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner’s standard key system; coordinate with Owner.
2. All NEMA 1 enclosure panelboards shall be hinged “door-in-door” type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not used third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
7. Enclosure shall be for recessed or surface mounting as shown or as required.
8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.

B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.

C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.

D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.:

Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

E. Fuses: Install fuses, of the ratings and class shown.

F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.

G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.

H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as “not used” and include panel identification.
1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.
2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.

I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.

J. Circuit breakers and conductors installed for SPD devices shall be located on the same side as the SPD to allow the shortest and straightest run of conductors in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.

K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.

L. Install panels so that breaker number 1 is the top left breaker.

M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.

N. Label breaker mounting space with stick-on number labels.

O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

3.2 TESTING

A. Before energizing, energization, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.

END OF SECTION

SECTION 26 24 25
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.

B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Switch Mechanism:
1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a

ground conductor is present in the circuit, provide a separate solid ground with the safety switch.

E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

A. Overcurrent protective devices 1,200 Amps and below:
1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
2. Molded case circuit breakers:
a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
3. Fusible switches:
a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
c. 600 Amps and below equipped for Class J fuses.
d. 601 Amps and above shall be equipped for Class R or L fuses.
e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
2. The ground fault system shall be factory-tested before shipment as specified:
a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
b. Relays, electrically operated switches, shunt-trip switches, circuit

breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.

c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.

B. Enclosures in exterior locations shall be NEMA 4X stainless steel.

C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.

B. Location: Provide safety switches within 50’ and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).

C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.

D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.

E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.

F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: “WARNING” (1/2 Inch Letters). “TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE.” (1/4 inch letters).

G. Provide disconnect switch for electric duct heaters.

H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.

I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

3.2 TESTING

A. General: Before energizing, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 24 30
FUSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Fuse work as shown and scheduled, and as specified.

B. Types: Fuses required for the project include the following:
1. 250 volt current limiting fuses
2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.

B. Types:
1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.

B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION

SECTION 26 27 73
LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

A. UL Label: Wiring devices shall be UL labeled.

B. NEMA Standard WD1 and WD6.

C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.

B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277-Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.

C. Submit manufacturer's product data sheet for each style of device and plate on the project.

D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toggle switches, straight blade and twist lock devices, interior cover plates:
1. Leviton
2. Hubbell
3. Pass and Seymour

B. Dimming
1. Leviton
2. Lutron

2.2 WIRING DEVICE COLOR

A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

2.3 RECEPTACLES

A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
5. 20A, 125V plug load control, split circuit marked for “controlled”, tamper resistant: Leviton #TDR20-S1G
6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX

B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.

C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (orange)
3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX

D. USB 2-port charger / tamper-resistant with 125-Volt receptacles:
1. USB type A/C, 1 type A and 1 type C port, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5833-HGX
2. USB A, 2 type A ports, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5832-HGX

E. USB 4-port charger:
1. USB type A+C, 2 type A ports and 2 type C ports. 5.0A 5.0VDC charging. Hubbell #USB4ACX.
2. USB type A, 4 type A ports. 5.0A 5.0VDC charging. Hubbell #USB4X.

2.4 WALL SWITCHES

A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
   1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
   2. Double pole 120/277V, 20A switch: Leviton #1222-2X
   3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
   4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
   5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
   6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G

B. Toggle key operated switch (verify manufacture and key type with Owner prior to construction).
   1. Single-pole, 120/277V, 20A key operated switch: Hubbell HBL #1221GY
   2. Two-pole, 120/277, 20A key operated, Hubbell HBL #1222GY
   3. Three-way, 120/277V, 20A key operated switch: Hubbell HBL #1223GY
   4. Four-way, 120/277V, 20A key operated switch: Hubbell HBL #1224GY
   5. Momentary, single pole double throw, center off, 20A key switch: Hubbell #HBL 1557LG.
   6. Key: Hubbell #HBL 1209. Key switches shall be keyed alike to match the Owner’s standard key system. Coordinate with Owner.

C. Rotary key operated switch (verify manufacturer and keying with Owner prior to construction).
   1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
   2. Two-pole, 120/277, 20A key operated, Leviton #1222-2KL.
   3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL
   4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
   5. Key switches shall be all keyed alike to match the Owner’s standard key system. Leviton #WS-35 or as otherwise directed by Owner.

2.5 WALL DIMMERS

A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
   1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
   2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
   3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
   4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
   5. Color change kit as required.

2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GFBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: DRINKING FOUNTAIN GFCI).

2.7 INTERIOR WALL COVER PLATES AND FASTENERS

A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).

B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
   1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
   2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word “EMERGENCY”.
   3. Text orientation shall be upright, readable from left to right when cover plate is installed.
   4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
   5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream (“EDF” for drinking fountains, “RM RECEPTS”, “HOOD RECEPTS”, “VENDING”, “REFRIG”, etc.) For other loads, Owner/Architect shall determine name plate wording.

2.8 EXTERIOR COVER PLATES

A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
   1. Vertical mount receptacle: #CKSUV
   2. Horizontal mount receptacle: #CKMU
   3. Two-gang: #2CKU
   4. 30-60 Amp Devices: #CKLSUV

2.9 CORD REELS AND DROP CORDS

A. Cord Reels:
   1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
   2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
   3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
   4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
   5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.

B. Drop cord receptacles:
   1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
   2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
   3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

2.10 FIRST RESPONDER EMERGENCY REMOTE POWER OFF (FREPO) STATION

A. Knox Company Remote Power Rapid Access 4500 Series Shutdown Station
   1. Recessed mount for public spaces and new construction, surface mount for when mounted to equipment or existing construction.
   2. Single lock keyed for local Fire Department/AHJ, verify configuration and keying with Knox Company.
   3. Red Finish
   4. Tamper alert for integration with building security system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
   1. Key switches and keys shall be as specified and also as approved by Owner.
   2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.

B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.

D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.

E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.

F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.

G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.

H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.

I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.

J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.

K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)

L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.

M. Do not share neutral conductor on load side of dimming switches.

N. Install receptacles with grounding pole down, except in any of the following conditions where the grounding pole shall be installed in the up position: healthcare occupancies, if required by local AHJ, if required by Owner's construction standards or if directed by Owner or Architect. If installed horizontally, install with neutral pole on top.

O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

P. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.

Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.

R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.

S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.

T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

3.2 GROUND FAULT PROTECTION FOR PERSONELL

A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.

B. GFCI personal protection locations include but are not limited to the following:
1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.
2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.

3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
   a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
   b. Bathrooms/toilets/restrooms
   c. Janitors/custodial closets and mop sinks.
   d. Laundry areas
   e. Parking structures, service garages, garages and accessory buildings
   f. Basements, crawl spaces (including 120-Volt lighting)
   g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
   h. Indoor damp and wet locations
   i. Locker rooms
   j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
   k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
   l. Receptacles serving dwelling unit kitchen counter tops
   m. Vending machines
   n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits, hoist ways, well ways or those mounted on the cars of elevators and dumb waiters.
   o. Electric vehicle charging equipment.
   p. All receptacles serving kitchen or food preparation counter tops.
   q. Automotive vacuum machines
   r. Drinking water fountains/coolers and bottle fill stations
   s. Corded high-pressure spray washing machines
   t. Tire inflation machines
   u. Dish washers
   v. Receptacles at end of cord reels or drop cords.
   w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes shore power that requires GFPE).
   x. Central plant, mechanical rooms and electrical rooms
   y. Wood, metal, or other material fabrication or vocational training shops.
   z. Receptacles that serve educational science and science prep room counter tops.

C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.

D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.

E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.

3.3 FIRST RESPONDER REMOTE EMERGENCY POWER OFF (FREPO) STATION

A. Provide Knox Company first responder remote emergency power off (FREPO) stations as indicated and/or where required by local AHJ. Mounting locations shall be as directed by the local AHJ and exact locations coordinated with the Architect. FREPOs shall be circuited only to shunt trip or shut-down control circuiting. FREPOs shall be recessed mounted in public locations and in all new construction when attached to building construction. Provide surface mount FREPOs when mounted to equipment or existing construction.

B. Integrate the FREPOs to shut-down the building non-emergency and non-legally required power sources which include the main electrical utility service disconnect circuit breaker(s), other than non-life safety or non-legally required distribution scale UPS equipment, and non-life safety or non-legally required local power generation equipment.

C. Provide FREPOs for fire pump, life safety, and legally required electrical generation equipment only when required by the AHJ. When required by the AHJ, fire pump, life safety, and legally required power generation and/or stored energy power supply equipment shall each have separate dedicated FREPOs that shut down only their associated power generation/stored energy equipment. FREPOs for emergency, and legally required systems shall have minimal 25-foot physical separation from the building main utility service FREPOs and clearly labeled with the equipment that they will shut down. FREPOs for fire pumps shall have minimal 25-foot physical separation from the any other FREPOs and from the building main utility service disconnect and clearly labeled with the equipment that it will shut down.

D. Integrate the FREPOs tamper switch with the building security or building management control system (BMCS) as directed by Owner.

3.4 TESTING

A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.

B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.

C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.

D. Operate each wall switch with circuit energized and verify proper operation.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5th Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.

B. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
1. UL 1449 Fifth Edition
2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
4. IEEE 1100 Emerald Book.
5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
6. UL 1283 – Electromagnetic Interference Filters

B. When requested for verification, provide copies of the following:
1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.

B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.

C. Copies of Manufacturer’s catalog data, technical information and specifications on equipment.

D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 5th Edition and UL 1283.

F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
   1. Recessed mount panelboard extension with brushed stainless-steel front:
      a. ACT Communications:471- ###V-050-SS-F-PB flush series.
      b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
      c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
      d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
   2. Branch panelboard surface mounted:
      a. ACT Communications 455 series.
      b. ABB Current Technology CG3 60 series.
      c. SSI Surge Suppression, Inc. CSMx12 series.
      d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C

B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
   1. ACT Communications 471 series.
   2. ABB Current Technology CGP3 125 series.
   3. SSI Surge Suppression, Inc. CSMx24 series.
   4. SST Southern Tier Technologies T45-VVVV-120A series

C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
   1. ACT Communications 471 x200 series.
   2. ABB Current Technology TG3 200 series.
   3. SSI Surge Suppression, Inc. CHLxM series.
   4. SST Southern Tier Technologies T45-VVVV-200A series

D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
   1. ACT Communications 471 x200 SEL series.
   2. ABB Current Technology SEL3 200 series.

   The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be

determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.

B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.

C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
1. 14 dB from 10 kHz to 1 MHz.

E. Each Unit shall provide the following features:
1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
2. Field testable while installed.
3. High performance interconnecting cable.
4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA

6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
7. The unit shall be listed as a Type 2 SPD per UL1449.
8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

2.3 POWER CABLES FOR CONNECTION

A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be high performance interconnect system “Low Z Cable” cables with Ultra Low impedance characteristics at 10kHz and above.

B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.

B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.

C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.

D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer’s recommendations shall prevail over the information given in the plans and specifications.

E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
1. Service entrance rated 1,201 Amps and above.

B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
1. Service entrance rated 801 – 1,200 Amps.
2. Switchboards located outside.

C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 401 - 800 Amps.
   2. Panelboards above 600 Amps.
   3. Motor control centers.
   4. Non-service entrance switchboards.

D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 400 Amps and below.
   2. Panelboards 600 Amps and below.

3.3 TESTING

A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
   1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.
   2. Verify overcurrent device rating.
   2. Verify all wiring connections and installation conforms to manufacturer’s recommendations.
   3. Record information for each product installed and include in O&M Manual

B. A copy of the Factory diagnostic test report and written approval of the installation shall be included with the Electrical Operating and Maintenance Manual. The Contractor shall make all adjustments, changes, corrections, etc. as required by the Factory Trained Representative so that the installation follows the manufacturer’s installation and operation instructions without additional charge to the Owner.

END OF SECTION

SECTION 26 46 02
EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
   1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
   2. Supply, install and wire all field hardware, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required. Use and expand the existing fire alarm control panel.
   3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
   4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.

B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this section. The Contractor shall provide all fire alarm and initiation devices in new and renovated areas required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

A. Divisions 22, 23 and 26

B. Fire Suppression Systems

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

A. National Fire Protection Association (NFPA):

1.	NFPA1	Fire Code
2.	NFPA 13	Systems, Installation
3.	NFPA 17	Dry Chemical Extinguishing Systems
4.	NFPA 70	National Electrical Code
5.	NFPA 72	National Fire Alarm and Signaling Code.
6.	NFPA 80	Fire Doors and Fire Windows
7.	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems.
8.	NFPA 92A	Smoke Control Systems
9.	NFPA 101	Life Safety code.
10.	NFPA 105	Smoke Control Door Assemblies
11.	NFPA 1221	Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.
12.	NFPA 2001	Fire Extinguishing Systems, Clean Agent

B. UL: Underwriters Laboratories, Inc.
1. 217 Single and Multiple Station Smoke Detectors.
2. 268 Smoke Detectors for Fire Protective Signaling Services.
3. 864 Control Units for Fire Protective Signaling Services.
4 864 Transient protection
5. 1480 Speakers for Fire Protective Signaling Systems
6. UL Fire Protection Equipment Directory.
7. UL Electrical Construction Materials Directory.

C. Factory Mutual P7825 Approval Guide

D. American National Standards Institute (ANSI).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic Engineers (IEEE).

G. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.

H. Requirements of American Disabilities Act (Public Law 101-336).

I. Local Accessibility Standards, Codes, and Ordinances

J. State Fire Marshall or Requirements of Local Authorities having Jurisdiction

K. State Insurance Code.

L. National Building Code.

M. International Building and Fire Code adopted by Local Authority Having Jurisdiction

N. Uniform Building Code.

O. Local & State Building Codes.

P. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years. All components of the system shall be UL compatible with the existing main fire alarm control panel. Manufacturer of all components shall match existing manufacturers of similar or same type components unless otherwise specified or noted on the drawings.

B. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.

C. The entire Fire Detection and Alarm System shall be installed by a factory authorized representative of the existing main fire alarm control panel and certified by the

manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.

D. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.

E. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.

F. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.

G. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.

H. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall'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.

I. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems.

J. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.

K. Material shall be new and in perfect condition when installed.

L. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

1.5 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.

1.6 DEFINITIONS

A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
   1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
      a. The operation of a manual station.
      b. The operation of a fire suppression system switch.
   2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
   3. Supervisory Signal: A signal, which signifies the impairment of fire protection

system, which may prevent its normal operation.

4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

A. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the Authority Having Jurisdiction for approval. All approvals shall be noted on the drawings or by letter from the Authority Having Jurisdiction. Submit copies of the Authority Having Jurisdiction approved shop drawings to the Architect for review.

B. Fire alarm submittal shall be bound and separate from all other submittals. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:

1. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
2. Complete point-to-point wiring diagrams of new equipment.
3. Complete floor plan drawings locating all new system devices and existing panels used for expansion.
4. Complete system bill of material.
5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
6. Provide a complete description of system operation.
7. Manufacturer’s installation instruction.
8. Bound form with contractor's name, supplier's name, project name, state fire alarm license, Fire Alarm Planning Superintendent license and all Technician(s) license adequately identified.
9. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
10. Complete set of manufacturer’s operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
11. Field and factory wiring diagrams of all new systems and for typical devices showing all connections with all terminals and interconnections identified.
12. Complete schematic circuit diagrams for all new equipment, including panel modules.
13. Floor plan drawings including all existing main and new panel and device locations, conduit sizes between devices and panels; number, size and type of conductors between devices and panels; walls, doors and graphic room numbers; exact power requirements and conduit routing with the location of all junction boxes and exact locations of devices and equipment. Submit a floor plan drawing circuiting/zoning shall be identified on the drawings.
14. Complete wiring, routing, and schematic diagrams, software descriptions, and details required to demonstrate that the system has been coordinated and will function as a system.
15. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
16. Detailed list of all hardware components, which are included.

17. Installation details for each type of field mounted device installed under this contract.
18. Point-to-point termination schedules with cable identification numbers and terminal strip numbers.
19. New fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
20. Submit a riser diagram of trunk wiring and device-to-device wiring and device to fire alarm control panel wiring. Riser shall show:
    a. Conduit sizes and types.
    b. Number, size and type of conductors.
    c. Fire detection and alarm devices arranged in the required circuiting/zoning, as defined in the specifications and on the drawing.
    d. Battery calculations to show compliance with the requirements of the specifications for both alarm and supervisory mode.
21. Indicate visual alarm device candela setting required for coverage.
22. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.

B. The Operation and Maintenance Manual shall consist of the following:
1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.9 AS-BUILT DRAWINGS

A. Prepare and submit detailed “As-Built” drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 WARRANTY

A. All new fire alarm devices, new panels, new equipment and new accessories, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification.

B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.

C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

E. Provide a certified fire alarm test of the complete system at the end of the warranty period and correct any and all items located in the area of renovation to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts within the area of renovation at no cost to the Owner.

F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of “As-Built” drawings and schematics of all equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers acceptable contingent upon Products’ compliance with the specifications:
1. Match Existing main fire alarm panel manufacturer.

2.2 SYSTEM DESCRIPTION

A. System shall be a fully functional fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified shall have voice alarm notification wherever audible notification is required.

B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
   1. Alarm
   2. Trouble.
   3. Open
   4. Short
   5. Device missing/failed.

C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.

D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.

F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.

G. Auxiliary manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble.

H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.

I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.

J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.

K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.

M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.

N. All addressable devices shall have the capability of being disabled or enabled individually

from the fire alarm control panel.

O. A maximum of 90 addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.

P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.

R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.

S. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. Existing to remain.

B. The fire alarm control panel shall be left with 25% spare initiating point and battery capacity for future use.

C. New power supplies (if required) shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of two (2) 110cd visual devices in the future. Individual circuit design loading shall not exceed 70% of power supply and system wiring capacity when including the additional spare capacity for the 110cd visual devices

1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, and AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
3. Each power supply shall be monitored and have an individual address.

2.4 DIGITAL FIRE ALARM COMMUNICATOR

A. Existing to remain.

2.5 EMERGENCY VOICE ALARM COMMUNICATION SYSTEM

A. Existing to remain.

B. Compatible and UL listed with existing fire alarm system.

2.6 NEW FIELD DEVICES WHERE REQUIRED

A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.

B. Visual Signals
1. Strobe lights shall be low profile and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
2. All wall mounted strobe units installed in student's toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover.

C. Combination Alarm Signal and High Intensity Visual Signals
1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
2. All wall mounted combination units installed in student toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover
3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.

D. Exterior Audible Signal:
1. Semi-flush mounted, molded of high impact red thermoplastic and listed for weatherproof locations.

E. Combination Voice Signal and High Intensity Visual Signals (where indicated or required by local AHJ):
1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
2. All combination units installed in student toilets, gymnasiums, student locker / dressing rooms shall have a protective cover.
3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.

4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.

F. Ceiling mounted recessed mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle or 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles (where indicated or required by local AHJ) and capacitor for line supervision.

G. Surface mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision.

H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present, except when mounted next to main FACP, staff supervised locations, and remote annunciators.

I. Intelligent Multi-Criteria Photoelectric Smoke Detectors
1. 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 thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
2. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
3. The detectors shall provide address setting means electronically and automatically at the control panel.
4. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.

6. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Intelligent Photoelectric Smoke Detectors
1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
2. The detectors shall provide address setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.
5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

K. Duct photoelectric smoke detectors:
1. Detectors shall be analog addressable type.
2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke 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 requirement of interface zone modules.
7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts 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.
8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
9. The detectors shall provide address setting means electronically and automatically from the control panel.

L. Intelligent Thermal Detectors
1. The detectors shall use dual electronic thermostats to measure temperature

levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.

2. The detectors shall provide address setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base.
5. Thermal Detectors shall be combination rate-of-rise and fixed temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as shown on the drawings and where required by local code authority.
6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.

M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.

N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.

O. Monitor Module:
1. Addressable monitor modules shall be provided 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.
2. The monitor module shall provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.

P. Control Module
1. Control/relay modules shall be provided 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 provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.

Q. Auxiliary Interface Points: All auxiliary input points (kitchen hoods, water flow, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.

R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

S. Beam detectors:
1. Microprocessor based beam detectors, consisting of a separate transmitter and matching receiver.
2. Coverage up to 350 ft. X 60 ft.
3. LED status indicators for normal (green), alarm (red), and trouble (yellow).
4. The detectors shall provide address setting means electronically and automatically at the control panel.

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.

B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
2. Permit the automatic roll down fire doors/shutters to close automatically.
3. Permit the security grilles with emergency egress to open automatically.
4. Unlock the electrically controlled access doors in all interior spaces.

C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.

D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE PAGING UNIT

A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.9 REMOTE ALPHANUMERIC DISPLAY ANNUNCIATORS

A. (Where indicated or required by Local Authority Having Jurisdiction) Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an 80-character display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and

function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:

1. Integral time/date clock
2. System reset
3. System silence
4. System acknowledge
5. Display/step switch
6. Integral trouble buzzer
7. LCD contrast adjust
8. Fire Drill Operation
9. Owner's list of additional remote annunciator control buttons.

B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:

1. 80 character alphanumeric display, LCD, LED, or gas plasma
2. Individual red system alarm LED
3. Individual yellow supervisory service LED
4. Individual yellow trouble LED
5. Green "POWER ON" LED
6. Alarm acknowledge key
7. Trouble acknowledge key
8. Alarm silence key
9. System reset key
10. LED test
11. Additional control buttons as directed by Owner.

2.10 AUXILIARY EQUIPMENT MONITORING

A. The fire alarm system shall monitor for alarm, supervisory, and trouble conditions; and annunciate the status of the following equipment when provided, or is existing to remain, as part of this project. A failed status shall activate the trouble alarm.

1. Emergency Generator: Run Status
2. Emergency Generator: Trouble Signal
3. Fire Pump: Run Status
4. Fire Pump: Trouble Signal
5. Emergency Service Communications Systems, as required by NFPA 72 and NFPA 1221.

PART 3 - EXECUTION

3.1 EXPANSION OF EXISTING SYSTEM

A. Testing of existing systems:

1. Provide complete operational test of existing fire alarm system prior to any demolition or construction. Verify operation of each device, control panel, distribution equipment and associated accessories.
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. In addition, provide deficiencies of the existing system with regard to current Code, ADA, and Local Accessibility Standards requirements. Provide the written report 14 days prior to any work related to the expansion of the existing system.
3. Testing of the existing system shall include all areas and all buildings served by the existing system.

B. Expand the existing system in all expansion or renovation areas to include requirement specified and as required by the local authority having jurisdiction. Verify compatibility of new equipment with existing system.

C. Provide smoke detectors in the following locations in addition or renovated areas:
1. All paths of egress and adjoining spaces within the same envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
3. At each computer lab/room.
4. At each library or book storage room.
5. At each storage room, stock room, or warehouse space.
6. At each pre-K and kindergarten classrooms.
7. At nurse's area/clinic and patient care/cot areas.
8. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.
9. At each student toilet/restroom. Provide STI protective covers. Do not locate over plumbing fixtures or near partitions.

D. Provide heat/thermal detectors in the following locations in addition or renovated areas:
1. At each mechanical room subject to un-treated or un-filtered outside air.
2. At each janitor's closets and laundry rooms.
3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
4. At each employee break room.
5. At each vocational shop.
6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.

E. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.

F. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
1. Where duct smoke detectors are installed above ceilings, provide external remote status/alarm LED mounted flush with ceiling in close proximity to the duct detector location. If space is open without ceiling, wall mount remote status/alarm LED in close proximity to the detector between 96 and 108-inches AFF, or as directed by Owner.

G. Provide duct smoke detectors on outside air units only as required by local Code and / or AHJ.

H. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums to avoid exposed conduits.
2. High ceiling areas 25 feet and higher where maintenance of spot type detectors will be difficult.
3. Skylights to avoid exposed conduits.
4. Coolers/Freezers 200 square feet and larger.

I. Provide manual pull stations at each exterior exit and at each exit from all floors only if required by local AHJ or if the building is not fully sprinklered. Provide one manual pull station at the central reception area as directed by Owner.

J. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
2. Courtyards and outdoor assembly areas adjacent to the building.
3. Mechanical yards adjacent to the building.
4. Covered playgrounds or covered assembly areas adjacent to the building.
5. Additional locations where indicated on drawings.
6. Outdoor paved play areas.

K. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

L. Provide beam type detectors at the following locations when appropriate:
1. Atriums.
2. High ceiling corridors where maintenance of spot type detectors may be difficult.
3. Areas with skylights.

M. Provide audio and visual alarm devices in all areas normally occupied by students or minors. The renovated and expansion areas' smoke control envelope audio alarm shall be equipped with voice alarm capability regardless of local AHJ requirements. Existing areas shall remain temporal audio alarm only.

N. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.

O. Provide carbon monoxide detection in classrooms and other instructional spaces served by a fuel-burning appliance, fuel-burning HVAC equipment (including roof mounted equipment), or with gas fuel outlets for connection to portable fuel-burning space heaters and appliances such as Bunsen burners which are typically used in laboratories or science classrooms.

3.2 GENERAL REQUIREMENTS

A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.

B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.

C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.

D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.

E. Visual displays, GUIs, or other indicators for main fire alarm panel and all remote

annunciators shall be at maximum 66 inches AFF.

F. All remote booster and associated equipment panels shall be mounted with top of enclosure maximum 66 inches AFF.

G. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.

H. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.

I. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.

J. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.

K. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.

L. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area, as required by the Local AHJ, and additional annunciators where indicated on the drawings, as directed by Owner / Architect.

M. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.

N. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.

O. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.

P. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.

Q. Power for magnetic door holders shall be provided from the nearest receptacle circuit wired through fire alarm relay.

R. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.

S. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for each new main fire alarm control panel, each new panel extender and each new remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not

available at the project site, power shall originate from the nearest available 120-volt panel, or as indicated.

3.3 CABLE AND BOXES INSTALLATION

A. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.

B. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.

C. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.

D. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.

E. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.

F. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.

G. 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%.

H. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings.

I. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.

J. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

K. All junction boxes containing fire alarm wiring are to be painted red.

L. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with cable ties on a maximum of 2'-6". Install cables in D-ring hangers secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork or foreign equipment.

M. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.

N. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment

manufacturer, and as indicated on the engineered shop drawings.

O. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.

P. No other wiring shall be run in the same conduit as fire alarm wiring.

Q. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations.

R. Copper wiring leaving or entering main building shall be protected on both ends with surge suppression; otherwise use fiber-optic cabling.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

A. General:
1. All fire alarm circuits shall be electrically supervised.
2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.

B. Fire alarm operating sequences shall be as follows:
1. Activation of any automatic detector, manual station, fire suppression system, sprinkler flow switch or any other system required by NFPA 72 to be monitored to initiate an alarm condition shall cause the location of the alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
b. The 80-character display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location based on actual room graphic name and number (not architectural plan names and numbers), 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 point shall be illuminated as herein specified.
d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
f. De-activate local sound reinforcement systems that are not UL listed nor integrated with the fire alarm system control panel for providing fire alarm or mass notification instructions. Building wide public address systems shall remain active only for manual mass notification. Public address

system auxiliary audio inputs used for background music or other remote non-emergency audio sources shall be silenced to only allow priority level manual mass notification using the public address system.

g. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
h. De-activate all HVAC systems including low speed high volume (LSHV) circulating blade type fans.
i. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
j. Close all related smoke dampers.
k. Close all related smoke/fire dampers.
l. Release all magnetic door hold open devices.
m. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
n. Release Counter Shutters and hold-open devices on all fire and smoke doors.
o. Open all security grilles with emergency egress.
p. Activate to close all related fire and smoke doors and shutters.
q. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
r. Signal the building automation system and Owner's security / police personnel as directed by Owner / Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged, and appropriate action has been taken.
s. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
t. Record all events on the system printer.

2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall initiate the Alarm Sequence of Operation.
3. Activation of a control valve supervisory switch shall initiate the following events:
   a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
   b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
   c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.
4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
6. Upon silencing the alarm, all visible alarm devices shall remain active until

system reset, and all local sound reinforcement systems de-activated by the fire alarm system shall resume normal operation.

7. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

C. Activation of the manual evacuation pull (drill) switch shall operate the alarm indicating appliances and de-activate local sound reinforcement system without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.

D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

A. Each new panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:

1. Name of manufacturer.
2. Manufacturer’s equipment description.
3. Serial number and model number.
4. Voltage and current rating.

3.6 SPARE PARTS AND TOOLS

A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.

B. Spare Parts: Provide minimum of one, or 5% of renovation area total, whichever is greater unless noted otherwise.

1. Spare shut down modules
2. Spare detectors of each type in the system
3. Spare alarm indicating devices of each type in the system
4. Spare manual pull stations
5. Spare protective covers of each type in the system.
6. Spare relays/controls required for connection to smoke and fire/smoke dampers
7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner’s cabinet.

C. Provide one smoke, heat and carbon monoxide detector testing kit. SDfire #TF2823 with Solo Testfire #2001 tester with 15-foot access pole and three 4-foot pole extensions, detector removal tool, and carrying bag.

D. Provide two copies of the final software programmed into the fire alarm system.

E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

A. Keys and locks for all equipment shall be identical to the existing building master key for the fire alarm system.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.

B. Coordinate motor operator voltage with supplier.

C. Open all dampers prior to starting air handling equipment.

D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS FOR AHJ SITE PERMITTING INSPECTION AND OWNER USE

A. It is the intent of these specifications that the fire alarm system shall pass AHJ inspection on the first try. The fire alarm system shall be fully functional, commissioned, and mapped both on fire alarm graphic maps and fire alarm annunciator device descriptions to fully and correctly described the device type and detailed location. Provide color coded floor plans detailed with actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers. Fire alarm maps shall include all relevant building information and fire alarm device information as required for the local AHJ permitting site walk-through inspection.

B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator.

C. Provide two color coded floor plans for Owner use that shall be solvent welded in acrylic plastic.
1. Mount in an extruded aluminum frame next to the main fire alarm control panel.

D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 ADDITIONAL REQUIREMENTS

A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner’s on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.

B. The contractor is to ensure all areas of the renovation and new construction are covered with visual and audio alarm devices for occupant notification of a fire alarm including remote portable or temporary buildings.

C. Coordinate door hold devices with door and door hardware.

D. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems (where new kitchen hood fire control systems are provided) and elevator equipment (where new elevators are provided).

E. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (2) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability with the two additional 110cd devices installed.

F. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

3.11 COMMISSIONING THE SYSTEM

A. The installing contractor shall be responsible for verifying that each new or relocated component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.

B. A state licensed and factory trained technical representative of the manufacturer with NICET Level 3 minimum certification shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Any new or relocated items located within the construction or renovation area found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded; electronic Excel and printed copy submitted to the Architect, Engineer and Owner.

D. The installing contractor shall provide a complete written report and printout of the functional test of the entire system after all existing deficiencies of the existing system have been corrected by the Owner, or as directed by the Owner. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be completed and accepted by the Owner prior to testing for the local Fire Marshall.

E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.

F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
4. Indicators shall be tested to ensure proper function and operation.

5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
8. Manual initiating devices:
   a. Each manual fire alarm station shall be functionally tested for alarm operation.
   b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
9. Automatic initiating devices:
   a. Each automatic initiating device shall be activated in accordance with manufacturer’s instructions to ensure proper operation.
   b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
   c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
10. Alarm signaling devices:
    a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area’s voice alarm signaling devices shall be tested for intelligibility.
    b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
11. Elevators: Each elevator shall be tested and automatic recall function verified.
12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.

G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance will be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.12 SUBSTANTIAL COMPLETION

A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.

B. All fire alarm system shop drawings, operating and maintenance manuals, maps and as-

built drawings shall be submitted to and accepted by the Architect / Owner prior to date of substantial completion.

END OF SECTION

SECTION 26 51 13
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Lighting fixture work is as shown, scheduled and specified.

B. Applications: The applications of lighting fixtures required for the project include the following:
   1. General lighting
   2. Emergency lighting
   3. Outdoor area lighting

1.2 QUALITY ASSURANCE

A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.

B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.

C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.

B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

C. Submittal data shall include luminaire efficiency parameters.

D. Submittal data for exterior luminaries shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
   1. Light fixtures:
      Acuity
      Signify
      Cooper Lighting Solutions
   2. LED Drivers:
      Philips
      Osram Optotronic
      Eldo LED
   3. Emergency Battery Packs with self-testing drivers/inverters: Shall be the same manufacturer as the low voltage lighting controls provided on this project. Where there are no low voltage lighting controls specified or provided, the manufacturer shall be Bodine.
      Bodine
      Chloride
      Lithonia
      Dual Lite
      IOTA
   4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible: Shall be the same manufacturer as the low voltage lighting controls provided on this project. Where there are no low voltage lighting controls specified or provided, the manufacturer shall be Bodine.
   5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
      Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.

B. Fixture Types:
   1. General:
      a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
      b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
      c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
      d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
      e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
      f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
      g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
      i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor
      j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life

(RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
3. LED Exit Signs: Provide red lettering. Exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes. Edge-lit exit signs shall have a silver background so that “EXIT” cannot be read backwards from the opposite side.
   a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafetoriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.

C. LED drivers:
   1. NEMA 410 compliant for in-rush current.
   2. Starting Temperature: -40˚ F [-40˚ C].
   3. Input Voltage: 120 to 480 (±10%) V.
   4. Power Supplies: Class I or II output.
   5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
   6. Power Factor (PF): ≥ 0.90.
   7. Total Harmonic Distortion (THD): ≤ 20%.
   8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
   9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.

E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.

F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
   1. Bodine BSL-ST Series for OEM installation
   2. Bodine BSL310-SI Series for field installation
   3. Bodine ELI-S Series for line voltage sine wave inverter field installation

G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.

H. Emergency Generator / Inverter Load Control Device (ELC):
   1. 16 Amp minimum ballast / driver load
   2. Compatible with 0-10 Volt dimmer switches
   3. UL 924
   4. Minimum 3-year warranty
   5. Integral or remove test switch.

I. Emergency Generator / Inverter branch circuit transfer switch:
   1. UL 1008
   2. 20 Amp ballast/driver load
   3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.

B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.

C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.

E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner’s designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.

F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafetoriums and kitchens.

G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.

H. Install in accordance with manufacturers instructions.

I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.

J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.

K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.

M. Install recessed luminaires to permit removal from below.

N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

O. Install wall-mounted luminaires at height as directed by Architect.

P. Install accessories furnished with each luminary.

Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.

R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.

S. Bond products and metal accessories to branch circuit equipment grounding conductor.

T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.

U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.

V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.

W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.

X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
1. Parking Lot Lighting
2. Building Mounted Lighting
3. Exterior Signage

Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.

Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.

AA. Lighting Fixture Supports:
1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

BB. Hardware for surface mounting fixtures to suspended ceilings:

1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Lighting Fixture Supports for aluminum canopies:
1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.

B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.

C. Final aiming and adjustment: Aim and adjust lighting fixtures for their intended purpose as specified or as required. Adjustments may include but not be limited to directional aiming, adjusting selectable lumen output, selectable correlative color temperature (CCT), selectable beam pattern, replacing/installing fixture manufacture’s optional optical lens used for adjusting beam patterns or for softening beam edges, replacing/installing manufacture’s optional theatrical/specialty color lens colors. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

Section 27 00 00 – General Technology Requirements

Part 1 - General

1.01 Project Summary

A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.

B. Full system functionality must be maintained during additions and renovations in unaffected areas.

1.02 Related Documents

A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.

1.03 Related Work

A. Section 27 05 00 – Communications General Requirements

B. Section 27 05 26 – Grounding and Bonding for Technology Systems

C. Section 27 05 28 – Pathways for Technology Systems

D. Section 27 05 37 – Firestopping for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.04 Definitions

A. Approved or Approval: Where approval is called for, only owner-authorized persons may approve. The owner reserves all rights to govern over and grant approval, and will appoint the authority of agents acting on their behalf.

B. As Required: The contractor shall provide the necessary quantity of said item. The Owner and Consultant reserve the right to determine the necessary quantities to offer a complete system.

C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner's project requirements. These consultant-produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.

D. Consultant: True North Consulting Group.

E. Contractor: The contractor is the qualified party responsible for providing all items and performing services described in these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.

F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.

G. End-User: Individual(s) who will ultimately operate the completed system.

H. ETR: Existing to Remain. The item is to remain in its current location and maintain its current functionality.

I. Furnish: To supply and deliver to the project site, ready for installation.

J. Install: To place in a position of service or use.

K. NIC: Not in Contract. The item will be the responsibility of others.

L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work, subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.

M. OFCI: Owner-furnished, contractor-installed. The owner will provide the Item, which will be installed by the Contractor.

N. OFE: Owner Furnished Equipment. The item will be provided and integrated by the Owner.

O. OFOI: Owner Furnished Owner Installed. The item will be provided and installed by the Owner.

P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.

Q. Provide: To furnish and install, complete and ready for intended use.

R. Substantial Completion: The stage in the installation process when the systems described herein are sufficiently complete, per the Contract Documents, so that the Owner can utilize such systems for their full intended use.

S. Turnkey: Of or involving the provision of a complete product or service ready for immediate use.

T. Work: Providing products and/or services to meet the requirements specified in these documents.

1.05 Full Reference Standards and Codes

A. Standards and other procedures referenced by this bid package are as follows:

1. ADA – Americans with Disabilities Act of 2010
   www.ada.gov/2010ADAstandards_index.htm

2. AIA – American Institute of Architects
   www.aia.org

3. ANSI – American National Standards Institute
   www.ansi.org

4. ASTM – American Society of Testing and Materials
   www.astm.org

5. BICSI – Building Industry Consulting Service International, Inc.
   (RCDD Standards)
   www.bicsi.org

6. CFR – Code of Federal Regulations
   www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
   (Available from the Government Printing Office)
   (Material is usually first published in the Federal Register)

7. U.S. Copyright Law, December 2011
   www.copyright.gov/title17

8. ECIA – Electronic Components Industry Association
   ESC – EIA Standards Council
   www.eciaonline.org

9. IACS – International Annealed Copper Standard
   www.ndt-ed.org/GeneralResources/IACS/IACS.htm

10. IEC – International Electrotechnical Commission
    www.iec.ch

11. IEEE – Institute of Electrical and Electronics Engineers
    standards.ieee.org

12. ISO – International Organization for Standardization
    www.iso.org

13. ITU-T – International Telecommunication Union – Telecommunication
    www.itu.int

14. NEC – National Electrical Code (NFPA 70)
    maintained by NFPA – National Fire Protection Association
    www.nfpa.org

15. NECA – National Electrical Contractors Association
    www.necanet.org

16. NEMA – National Electrical Manufacturers' Association
    www.nema.org

17. OSHA – Occupational Safety and Health Administration
    (U.S. Department of Labor, OSHA)
    www.osha.gov

18. TIA – Telecommunications Industry Association
    www.tiaonline.org/standards

19. UL – Underwriters' Laboratories
    www.ul.com

B. Standards: Referenced standards and/or procedures shall be binding on the Contractor, and work shall be judged against such standards and procedures unless otherwise stated in writing.

C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).

D. Owner Standards: Contractor shall obtain and abide by all published Owner standards pertaining to the work described herein.

E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.06 Qualifications

A. Refer to related sections for specific requirements.

1.07 Permits and Inspections

A. Responsibility: Obtain the permits and inspections required for the work. The contractor is responsible for all permit and inspection costs.

B. Performance: Perform tests required herein, or as may be reasonably required to demonstrate conformance with the specifications or the requirements of any legal authority having jurisdiction.

C. Review: Obtain approvals from authorities responsible for enforcement of applicable codes and regulations to establish that the work complies with all requirements of reference codes indicated herein and required by the appropriate jurisdiction. Make corrections, changes, or additions as required and deliver certificates of acceptance, operation, and/or compliance with the Operation and Maintenance Manuals described herein.

1.08 Drawings and Basis of Design

A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by the Contractor unless noted otherwise.

B. Interpretation: Work shall be installed per the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

1.09 Product Substitution Procedures

A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.

B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.

C. Requirements: The Request for Substitution shall include:

1. Reason for substitution.

2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.

3. Any cost impact to the Owner.

D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.

E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.

F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

1.10 Software

A. Versions: Consultant used the following software versions for this project:

1. Autodesk Revit MEP 2020 (floor plans)

2. Autodesk AutoCAD MEP 2018 (detail sheets)

1.11 Submittal Conditions

A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.

B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.12 Pre-Construction Procedures

A. Pre-Construction Submittal Meeting: Contractor shall schedule web conference (Microsoft Teams or similar) with Consultant to review basis of design and submittal expectations.

B. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.

D. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.

E. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.

F. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

G. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.13 Pre-Construction Submittals

A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.

B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

1. Qualifications: Shall include documentation of all required certifications and qualifications.

2. Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.

3. Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

4. Manufacturer's Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

1.14 Pre-installation Procedures

A. Refer to individual sections for additional information.

1.15 Construction Progress Procedures

A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.

B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.

C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.

1. The test plan shall be approved by Consultant prior to any testing.

1.16 Construction Progress Submittals

A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.

B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.

2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:

a. Identification of the capabilities and functions to be tested.

b. Detailed instructions for the setup and execution of each test.

c. Procedures for evaluation and documentation of the results.

C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.17 Closeout Procedures

A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.

B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.

1. Test Results
2. As-built drawings (full-size sheets)
3. Operation and Maintenance Manuals
4. End User Software

C. Photos that demonstrate complete system installation.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.

E. Final Inspection: At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

F. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.

G. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

H. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.

1. Record Drawings – AutoCAD 2020 editable .dwg format AND PDF.
2. Operation and Maintenance Manuals – USB flash drive.
3. End User Software – USB flash drive.
4. Documentation of testing and system certification.
5. Completed Minnesota Department of Revenue IC-134 Form.

I. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide one (1) digital copy with labeled bookmark dividers of all record drawings (full-size sheets) and operation and maintenance manuals, one (1) digital copy to Consultant. Title on cover page shall be "Operation and Maintenance Manual – [Project Name]". The following additional items shall be identified on the binder cover:

1. Client Name
2. Contractor Name and Contact Information

3. Consultant Name and Contact Information

4. Date

J. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.

K. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.18 Closeout Submittals

A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner's needs.

B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.

1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:

a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), Architect's Supplemental Instruction (ASIs), or Requests for Proposal (RFPs) in addition to any other changes to the original documents.

b. Actual device locations, conduit routing, wiring and relationships as they were constructed.

c. Nomenclature showing as-built wire designations and colors.

d. Room numbers coinciding with Owner space planning numbering.

2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.

3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:

a. A final Bill of Materials for each system.

b. A Microsoft Excel (.xlsx format) spreadsheet for each device that resides on the network, provide the following:

i. IP Address

ii. MAC Address

iii. Serial Number

iv. Manufacturer

v. Model Number

vi. Device Username

vii. Device Password

viii. Telecom Closet or Rack Location

ix. Patch Panel Port Number

x. Switch Port Number

xi. Any other relevant information as requested by Owner

c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.

e. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test, and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.

h. Sufficient information, (detailed schematics of subsystems, assemblies, and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

i. Any other items defined herein.

4. Local Reference Diagrams: Within each equipment rack, enclosure, or cabinet, the Contractor shall place a functional diagram of the system(s) in a clear plastic sleeve secured to the equipment rack, cabinet, or enclosure.

5. Intellectual Property: Provide all required items and written release as described herein.

6. Training Program: Proposed training materials and program outline.

7. Spare Parts and Remote Controls: Contractor shall submit record of Owner sign-off of turnover of spare parts and remote controls.

1.19 Project Management

A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.

B. Responsibility: Project Manager is responsible for the following:

1. Successfully completing the contract in a timely manner.
2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor, and ensuring compliance with specification.
3. Completing and submitting required documentation.
4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants in a timely manner.
5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.
6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.
7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.

C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

D. The Owner reserves the right to request a change of project manager at any time for any reason.

1.20 Examination of Existing Conditions

A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules, etc.) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.

B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.

C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.

D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notify Construction Manager and Consultant via email with attached photos.

E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

1.21 Contract Modification Procedures

A. Changes: Changes to the contract may be initiated by Owner, Consultant or Contractor.

B. Request for Information (RFI): If a change originates with Contractor, the Contractor shall submit an RFI for Consultant review. If it is deemed a change is necessary, the Consultant shall issue a PR to address the change.

C. Proposal Request (PR): If a change originates with Owner or Consultant, Consultant shall issue a Proposal Request to Contractor.

D. Change Proposal (CP): If a change originates with Contractor, or if Contractor receives a Proposal Request from Consultant, Contractor shall submit a Change Proposal to Consultant to review.

1. References: A Change Proposal shall reference the work to be performed, and shall include the cost change to the Project (if any) and the time change to the scheduled completion (if any).

2. Additional Information: Consultant may request additional information to be supplied with the Change Proposal for consideration.

3. Acceptance: Owner reserves the right to accept or reject Change Proposals.

E. Change Order: A Change Order is a modification of the contract.

1. If a Change Proposal is approved, Owner will issue a Change Order that references PR and/or CP. Change Order is not valid until it has been signed by Owner.

2. Work performed or equipment supplied outside of contract without a valid Change Order is done at Contractor's own risk.

1.22 Product Storage and Handling Requirements

A. Storage: Contractor shall provide secure material storage. If Contractor chooses to store cabling or equipment at project site, that Contractor shall receive written approval from GC or Owner to identify acceptable location. All equipment provided by the Contractor remains the responsibility of that Contractor until Owner has beneficial use of the equipment.

B. Protection: Contractor shall take all necessary precautions to protect materials from the following:

1. Theft

2. Vandalism/Tampering
3. Dents
4. Scratches
5. Dust
6. Temperature
7. Weather
8. Cutting
9. Paint
10. Other hazardous conditions

C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.

D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.

1.23 Interference with the Facility

A. Transportation and storage of materials at the facility, work involving the facility, and other matters affecting the habitual use by the Owner of the Owner's buildings, shall be conducted to minimize interference, and at times and in a manner acceptable to the Owner.

1.24 On-Site Conduct

A. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor's Personnel are to remain in project area.

B. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.

C. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, or its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take immediate steps to correct the hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.

1.25 Safeguards and Protection

A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.

B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.

D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.

E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.

F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

1.26 Owner-Furnished Products

A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.

B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.

C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.

D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

1.27 Quality Assurance

A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.

B. Qualifications: Contractor employees who are engaged in installation shall be adequately trained in the tasks they are expected to perform.

C. Acceptability: Owner shall determine the acceptability of work.

D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.

E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.28 Quality Control

A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that such connections will not have a negative impact which could reduce or hamper existing systems.

1.29 Owner's Right to Use Equipment

A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.30 Intellectual Property Ownership

A. All intellectual property shall remain in escrow for an unlimited period of time. All supporting documentation including but not limited to: software, firmware, programming, uncompiled source code, graphic files, diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a USB flash drive for all spaces and all systems. The integrator and/or programmer shall also maintain a current live copy incorporating all system modifications to be provided at the Owner's request and for system restoration upon a failure.

B. A written release shall be given by the Contractor and all other required parties for all programming and configuration done by the Contractor and/or Subcontractors. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

Part 2 - Products

2.01 Basic Equipment and Materials Requirements

A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.

B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.02 Factory-Assembled Products

A. Manufacturer: Reference to specific equipment manufacturers does not imply that all products produced by that manufacturer meet the specification requirements.

B. Age of Equipment: Equipment shall be new and unused with full manufacturer's warranties. Contractor shall supplement such warranties as required by the

specification. Contractor shall immediately notify Consultant of any product that will be or is expected to be discontinued by the end of the project for resolution.

C. No Modification: Where a product is available from a factory/manufacturer to meet the needs as outlined, that product shall be used without modification to ensure the full factory warranty is maintained.

D. Like Materials: Like materials used shall be of the same manufacturer, model, and quality unless otherwise specified.

E. Software/Firmware: No software or firmware is to be used unless specifically authorized by Owner or its appointed representative.

2.03 Racks, Cabinets, Hardware

A. Equipment Racks and Cabinets: Provide racks and cabinets as specified herein and/or described in accompanying documents, appendices, or drawings. Verify that any existing racks and/or cabinets provided by others are complete, bringing any discrepancies to the attention of Owner and Consultant prior to beginning the installation.

B. Shelves and Mounts: Contractor shall supply necessary mounting hardware to install rack-mounted equipment. Mounting hardware shall be a product of the manufacturer of the equipment to be mounted, or manufacturer of the rack system, or approved by either for use with their product. Provide supporting channels, shelves, rack mounts, and/or rack ears as recommended by equipment manufacturers.

C. Screws and Washers: Contractor shall provide screw head types appropriate to the level of security required for the equipment and racking. Screws shall include polyethylene or nylon washer.

1. Public Access Areas: Star post or square post security screws shall be used for hardware and equipment mounted in equipment racks and consoles in areas that are accessible to the public.

2. Restricted Access Areas: Philips head screws may be used where a secure room entrance or locked rack/console door prevents public access.

2.04 Power Devices

A. Power Strips: Unless otherwise specified, power strips shall be UL listed and rated for 20 amp continuous electronic loads. Outlets shall be 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Cords shall be 12/3 SJT with molded plug.

B. Power Distribution Panels: Unless otherwise specified, power distribution panels shall be UL listed, rack mounted, rated for 20 amp continuous electronic loads, with switch and pilot light. Up to eight outlets shall be mounted to the back, each rated 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Switch and pilot shall be mounted to the front. Cords shall be 12/3 SJT with molded plug.

C. Contractor shall provide acceptable power distribution units as required in order to provide sufficient outlet connectivity for Contractor-furnished and Owner-furnished equipment indicated on drawings and equipment schedules, plus up to 20% additional capacity for future growth. This may be in addition to any power distribution equipment indicated on equipment schedules.

2.05 Cable and Connectors

A. Cable: Cable shall be selected and applied in a manner defined by signal type, consistent with best industry practices. Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Where required by the NEC, substitutions of air handing plenum cable shall exactly match the normally applied product and shall meet the standards of UL Standard #900 and the NEC Articles 800 and 820.

B. Connectors: Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Strain reliefs and cable clamps shall be sized for the connector and the cable.

C. Color: Cable and connector color shall be coordinated with Consultant to maintain consistency with cable and connector color schemes used by other trades.

2.06 Cable Management

A. Plastic Cable Ties: Single use white nylon plastic cable ties, appropriate screw fittings, or mounting clips may be used for AC power cable management within racks and enclosures. Plastic/nylon cable ties shall not be used for signal and DC cables.

B. Velcro Cable Ties: Velcro straps shall be used for all signal and DC cables. Velcro straps shall be black, with no logo or decoration, except as authorized by Consultant.

2.07 Ancillary Hardware

A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.

B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items of work or equipment necessary to complete or make the installed system fully functional can be omitted.

2.08 Grounding Hardware

A. Refer to Section 27 05 26 for specific Grounding and Bonding requirements.

B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to,

cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

2.09 Compatibility of Related Equipment

A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.

B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

2.10 Licenses

A. Any and all licenses required for system functionality shall be provided.

2.11 Spare Parts

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

2.12 Maintenance Manuals

A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

Part 3 - Execution

3.01 General

A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.02 Coordination

A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.

B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.

1. Work by General Contractor.
2. Work by other Technology Contractors.
3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.

C. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.

D. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.

E. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

F. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

G. Surface-Mounted Raceway Coordination

1. General and Electrical Contractors: Contractor shall coordinate with General Contractor and Electrical Contractor the installation of surface-mounted-raceway where not provided but made necessary by non-penetrable wall.
2. Verification: Contractor shall field verify and coordinate the proposed use of surface-mounted raceway at any location with Consultant and Owner.

3.03 Basic Execution Requirements

A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.

B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operational efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.

C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.

D. Protection of Work Area: Work shall be properly protected during construction; including shielding soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic,

protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.

E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.

    1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at Contractor's sole cost.

F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.

G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of dumpster shall be arranged through Building Management. Appropriate measures shall be taken to protect asphalt or other ground surfaces.

H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.

I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.

J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.

K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.

L. Motorized Furniture: Care shall be taken to properly dress all cables placed within motorized furniture and provide sufficient cable length and strain relief to allow motorized elements to operate within their full range of travel.

M. Flexible Furniture: Care shall be taken to properly dress all cables placed within flexible or re-configurable furniture to provide sufficient cable length and strain relief to allow full range of travel for flexible furniture configurations.

3.04 Preparation

A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.

B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

3.05 Cleaning

A. Tool Clean-up: Contractor is not permitted to use restrooms for tool clean-up. A slop-sink may be provided in janitorial closet on each floor for cleaning of tools and equipment and as a source of water. Janitorial closet or maintenance area or shop shall be kept clean at all times. Contractor or Contractor's Personnel found using restrooms for clean-up or other similar purposes shall be subject to removal from building.

B. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.

C. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire and other debris from entering the carpet.

3.06 Demolition

A. General: The Contractor shall be responsible for removal, collection, transportation, and recycling of all cabling and components that become abandoned as a result of this project. This shall include the delivery of cable and components to the proper recycling centers. If material is to remain on site for more than seven days after removal, Contractor shall coordinate with Owner for an acceptable storage location.

B. Verification: Contractor shall field-verify existing conditions prior to beginning demolition work. Any discrepancies shall be reported to the Consultant prior to the start of work in order to prevent disturbance of existing installation(s). Beginning work shall indicate acceptance of existing conditions. Contractor is responsible for immediately restoring any outages caused as a result of removing or damaging adjacent cabling, systems, or services.

C. Abandoned Cable: The Contractor shall remove all abandoned cable back to the headend. Where it is not possible to remove cables without damaging other cables that are to remain, such as in a shared conduit, the Contractor shall report these conditions to the Consultant for approval. These cables shall be cut at entry and exit points, leaving a minimum of 24" of cable at each end.

D. Cover Plates: The Contractor shall provide and install blank cover plates for any outlets or junction boxes that are to be left in place and from which all cables have been removed. Cover plates shall match the Project standard color and finish.

E. Equipment: The Contractor shall remove all equipment abandoned as part of this project. The Contractor shall be responsible for the delivery of this equipment to a proper recycling facility. Any electrical service connected to the equipment shall be properly decommissioned and labeled to prevent any safety issues.

F. Right of Refusal: The Owner shall have first right of refusal to any abandoned cable or equipment. The Owner has the right to remove any components from the equipment before it is recycled.

3.07 Fire Stopping

A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.

B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

3.08 Waterproofing

A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.

B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.09 Racks, Cabinets, and Hardware

A. Racks and Cabinets: Contractor shall assemble and install racks and cabinets.

B. Installation Hardware: Install hardware in a secure manner. Screws shall be tightened to a torque just sufficient to secure equipment without deforming washers beyond their original diameter.

C. Considerations: Rack mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and in/out connections.

D. Cross Connections: Where cross connections are required between equipment, interconnections shall be installed using cable management devices to secure cables in a neat and workmanlike manner, applying best industry practices.

3.10 Installation Requirements

A. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and

pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

B. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away”, or other approved method.

C. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

D. All cable shall be free of tension at both ends.

E. PLENUM rated cable shall be used in areas used for air handling or where required by code.

F. Contractor shall replace any cables that have been damaged or abraded during installation.

G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used and will not harden or become adhesive with age.

H. A pull cord (nylon; 1/8” minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

3.11 Cable

A. Cable treatment: Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the rating of the manufacturer.

B. Splicing

1. Voice, data, and other twisted pair cables: No splices shall be installed in any voice, data or twisted pair cables.

2. Technology systems: No splices shall be installed in any cable less than five hundred (500) feet in length.

3. Digital multimedia/video cables: No splices are allowed in any digital multimedia/video cable.

4. Overhead paging systems: Cable splices for constant voltage overhead paging system shall occur only at speaker, amplifier or volume control knob locations.

C. Lengths

1. Variations: Where cables are to be of the same length, variations in the length shall be less than plus or minus ½ inch. Lengths of cables are based on the length of the unterminated signal conductors.

2. Labeling: Cables, regardless of length, shall be marked with a labeling scheme approved by Consultant.

3. Service Loops: A surplus of cable, located at or near the point of termination to facilitate potential future changes, shall be provided where appropriate. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

D. Grouping

1. Cables shall be separated into like groups according to signal or power levels.

2. Power Cable Group: Power cables shall be secured to one side of the rack separate from any low-energy signal cable groups. Separation shall be a minimum of 4" in all directions.

3. Signal Cable Group: Signal cables shall be grouped according to signal type and secured to one side of the rack separate from any power cable groups. Separation shall be a minimum of 4" in all directions.

E. In Equipment Racks

1. Equipment rack wiring and cabling shall be neatly dressed.

2. Fastening: Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

F. Support for Cables Outside of Equipment Racks

1. External wire and cables shall be supported at least every 5 feet (1.5m) from the structure and as required to maintain less than 12 inches of cable sag between supports without over-tensioning the cables. Contractor shall vary the precise distance between cable supports on long runs to avoid harmonics issues.

2. Hardware: Cables shall be supported by J-hooks, cable tray, or ladder rack. Hardware shall be secured to building structure using 3/8" threaded rod supports.

   a. Right Angles: Cables are to run at right angles to the structure, placed above ceiling in halls or corridors.

   b. Height: Cables shall not run above red iron joist.

G. Concealment: Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests. Cabling systems installed in public areas shall be

installed within walls, ceiling, or floors or within surface wiring pathways, as dictated by codes and good engineering practice.

H. Velcro Straps for Horizontal Cabling: Straps shall be installed snugly without deforming cable insulation. Straps shall be spaced at uneven intervals not to exceed 4 feet.

I. Cable Ties and Velcro Straps within Equipment Racks and Cabinets: Ties and straps shall be installed snugly, without deforming cable insulation, at uneven intervals not to exceed 8 inches. Cable ties shall only be used for non-signal carrying cables. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Obstruction: Contractor shall notify Owner immediately if any obstruction or hazard is discovered in a pathway provided by others.

3.12 Connectors

A. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

B. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner suited to the service of the wire and as directed by the manufacturer. Contractor shall use manufacturer specified terminations when those specifications exist.

C. Soldering: A person skilled in that practice shall execute soldered terminations. Any excessive insulation displacement resulting from soldering shall be grounds to require the Contractor to re-terminate the connector.

D. Adapters: Adapters shall be used only where the identity of the necessary type of connector is unknown at the time of installation, such as for Owner-provided equipment or in anticipation of future equipment upgrades, with Consultant's approval.

3.13 Spare Parts and Remote Controls

A. Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.

B. Refer to individual sections for spare parts and remote control requirements.

3.14 Equipment Installation

A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer's guidelines for installation shall be followed. Discrepancies in installation procedure or inability to complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.

B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, Contractor shall follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.

1. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.

C. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.15 Software and Firmware

A. At the completion of the project the Owner shall have the option to receive final software updates and firmware updates to the latest versions before the project is paid in full at no cost to the Owner.

3.16 Rough-In

A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.

B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage which may result from plastering, painting, cleaning, or other such work completed after installation and before substantial completion of the project.

3.17 Cutting, Drilling, Patching, and Painting

A. Coordination: Contractor is responsible for coordinating with the General Contractor and other trades when any cutting or drilling is required for the installation or proper performance of the specified systems.

B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting including painting.

C. Painting: Contractor is responsible to paint all new work including exposed pathway to match the conditions.

3.18 Labeling

A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.

B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.

C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Like Size: All labels, including engraved labels, shall be sized to match other labels used for same purpose.

2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading “No user serviceable parts. Refer service to qualified technician.”

3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.

5. Documentation: Labeling information shall appear on the as-built drawings.

3.19 Fire-Stopping

A. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials

3.20 Additional Engineering Services

A. General: Contractor is responsible for securing necessary engineering services were needed to meet the needs of the installation.

B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested in the contract documents will Owner entertain a Change Order Request for these services.

3.21 Testing

A. Procedure: Contractor shall develop a rigorous testing procedure to ensure full functionality and durability of installed systems under heavy-use conditions.

B. Supplies: Contractor shall supply testing equipment needed to verify compliance with specifications found in these documents.

C. Schedule: Contractor shall complete required testing prior to the substantial completion inspection by Owner and Consultant.

D. Data: Test data shall be properly documented and recorded so that it is available for final inspection.

E. Quality Control: Testing may be repeated during the inspection process at the request of Owner or Consultant.

F. Prior to energizing or testing the system, Contractor shall ensure the following:

1. Installation: Products are installed in a proper and safe manner per the manufacturer's instructions.

2. Cleanliness: Products are neat, clean, and unmarred, and parts securely attached. Dust, debris, solder, splatter, etc., is removed.

3. Cables and Connections: Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. Grounding: Electronic devices are properly grounded.

5. AC Power: Each AC power receptacle is tested with a circuit checker for proper hot, neutral, and ground connections prior to connecting equipment.

3.22 Grounding

A. Refer to Section 27 05 26 for specific Grounding and Bonding installation requirements.

3.23 Training Program

A. Contractor shall provide training in the manner delineated below in addition to specific requirements identified in subsequent sections.

B. Contractor shall provide audio-video recording of each training session to Owner.

C. Prior to scheduling or delivering End User training, Contractor shall confirm that:

1. Closeout submittals have been accepted by Owner and Consultant.

2. Final closeout inspection has been completed and punch list items rectified.

3. Training schedule dates have been coordinated with and approved by Owner and Consultant.

D. Training shall include:

1. Approved handouts.

2. Practical and comprehensive operation of systems.

3. Basic system troubleshooting techniques.

4. Basic system maintenance.

E. Training Blocks

1. Training time is defined as those hours specifically set aside for the sole purpose of training end users. Credited time will not be given for any time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training program.

2. This training will be divided into training session "Blocks" as coordinated with the Owner.

    a. The first training session block shall consist of training intended for the common system operators. Such training, at a minimum, shall include the day to day use of the system.

    b. The second training session block shall consist of training administrators of the day to day administration of the system. Such training, at a minimum, shall include use of the administration control functions of the systems, user setup, and filtering and pulling reports.

    c. The third training session block shall consist of training administrators on system troubleshooting, maintenance, and updates. Such training, at a minimum, shall include using the system tools to diagnose issues, diagnosing common physical equipment issues, performing simple maintenance, and performing system updates.

    d. The fourth training session block shall consist of a training session structured for high-level users, for example staff trainers who will provide instruction to other users and will include advance system configuration and operational knowledge needed to maintain and manage all specified technology systems. The Contractor may elect to engage the Manufacturer(s) in certifying the high-level end users in the systems at no cost to the Owner.

F. The Contractor shall issue a certificate of training completion to the trainees upon completion of their training. Such certificates must be signed by both the trainer and trainee(s) for the Contractor to receive training credit.

3.24 Warranty and Maintenance Program

A. Contractor shall provide a warranty conforming to the stipulations below in addition to specific requirements identified in subsequent sections.

B. As part of the base proposal cost, the Contractor shall include a 1-year turnkey warranty period with full support costs.

1. Pricing for warranty services for years two through five shall be itemized on the Contract's Unit Pricing Form as part of a complete response. At the owner's discretion, the owner may fund the additional warranty services separately or not at all.

C. The Warranty period shall begin after all punch list items have been rectified. The Contractor shall receive a letter of completion from the Consultant and Owner indicating project completion and starting the warranty period.

D. The warranty and support work included in this contract shall cover the following materials, software, and services, without additional cost to the Owner:

1. Inspections, preventative maintenance, and testing of equipment and components. The Contractor shall schedule a 10-month on-site preventative system review 10-months into each year of warranty and support including system inspections, preventive maintenance, software upgrades/patches, and testing of equipment and components.

2. Regular Service, Emergency Service, and Normal Service.

3. Labor, travel, equipment, materials, and transportation cost for all services covered by this warranty.

E. Response Time: Contractor shall respond to calls for warranty services in a timely manner as delineated below.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure.

2. Emergency service calls are defined as failures which prohibit the use of a typical system function(s) and pose a life safety concern, or such failures which cause a major impact to the Owner's daily operations.

a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.

3. Normal service calls are defined as failures which prohibit the use of typical system function(s) but which do not inhibit critical system usage, do not pose life safety concerns, and do not create a major impact to Owner's daily operations.

a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within forty-eight (48) hours after notification by the Owner.

4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any needed warranty service

F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within twelve (12) hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality and provided

permanent replacement is achieved within ninety-six (96) hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

G. Transmittal: A copy of this Warranty shall be delivered to and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

H. Registration: Contractor shall register Warranty papers for all equipment and software in the name of the Owner and furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

I. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

    1. Service/Warranty Procedures: Contractor shall submit a warranty service plan containing all contact information and Owner service call directions for Owner review with project close-out submittals.

J. Resolution of Conflicts:

    1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory and stating specific areas of dissatisfaction in writing.

    2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

End of Section

Section 27 05 00 – Communications General Requirements

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements related to furnishing and installing Category 6/6a Cabling and Termination Components and related subsystems as part of a Structured Cabling System.

C. Backbone system comprising copper and fiber optic cabling and horizontal (station) cabling is covered under this document.

D. Others will provide the network electronics for the LAN within the Telecom Rooms (TRs) and will be responsible for connecting the new cabling infrastructure to the LAN. The Contractor, however, shall supply the patch cords. The Contractor shall be available on site during the crossover to assist with any cabling issues that may occur during the connection.

E. The Electrical Contractor shall install conduits and surface raceway for new technology outlet locations unless otherwise noted.

F. The Telecommunication Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.

G. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).

H. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Electrical Code in the state where the work is to be performed, and present manufacturing standards.

I. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

J. Full system functionality must be maintained during additions and renovations in unaffected areas.

K. Remove and disconnect abandoned security equipment. Remove any abandoned cabling above ceilings and patch all penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

L. Kronos Clock / Time Clock, coordinate height, data, power and rough-in requirements with FBISD IT.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 26 – Grounding and Bonding for Technology Systems

C. Section 27 05 28 – Pathways for Technology Systems

D. Section 27 05 37 – Firestopping for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

B. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.

C. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

D. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

E. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

F. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

G. ANSI/TIA 569-E: Telecommunications Pathways and Spaces

H. ANSI/TIA 568.0-E, ANSI/TIA 568.1-E, ANSI/TIA 568.1-E, ANSI/TIA 568.2-D, ANSI/TIA 568.3-D, ANSI/TIA 568.4-D: Commercial Building Telecommunications Standard

I. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding

J. ANSI/TIA 606-C: Administration Standard for Telecommunications Infrastructure

K. ANSI/TIA 942-B: Telecommunications Infrastructure Standard for Data Centers

L. ANSI/TIA 607-D: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

M. IEEE: National Electrical Safety Code® (NESC®)
standards.ieee.org/about/nesc

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. The contractor shall have a minimum of 5-years' experience on similar projects.

C. The contractor shall have a minimum of (2) certified BICSI Installers in good standing and a full-time employee of the company and on-site at all times.

D. The Contractor project manager shall be an RCDD (Registered Communication Distribution Designer) in good standing and a fulltime employee of the company and be present at all on site coordination meetings.

E. All structured cabling systems shall be installed by an authorized and registered Panduit Gold Certified Installer in good standing.

F. RCDD and BICSI Certified Technicians will be present at the following meetings:

1. Low Voltage Preinstallation Meeting
2. Cabling System Pathway Mockup
3. Owner walks / System inspections
4. Coordination Meetings
5. And Other events as requested by the Owner

G. Premises Distribution System: Written certification that the premises distribution system complies with the ANSI/TIA 568.0-E, ANSI/TIA 568.1-E, ANSI/TIA 568.1-E, ANSI/TIA 568.2-D, ANSI/TIA 568.3-D, ANSI/TIA 568.4-D, EIA ANSI/TIA/EIA-569-E, and ANSI/TIA/EIA-606-C.

H. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, Contractor shall supply, upon request by Consultant or Owner, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements,

or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

I. Certifications

1. Documented proof that the contractors project manager is an RCDD shall accompany the proposal response.

2. Certificates of attendance will be submitted for attendance in manufacturer's installation/ maintenance training by the Contractor's directly employed personnel. All structured cabling systems shall be installed by an authorized and registered Panduit Gold Certified Installer in good standing.

3. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturers for installation of all proposed components. Company Certifications shall accompany the proposal response.

4. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.

5. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.06 Pre-Construction Submittals

A. The following items shall be provided in a single, combined, comprehensive submittal package for all Communications work, including sections 27 05 26 Grounding and Bonding for Technology Systems, 27 11 00 Communications Equipment Rooms, 27 13 00 Communications Backbone Cabling, and 27 15 00 Communications Horizontal Cabling. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in the section above, including RCDD, Panduit Gold, BICSI, and manufacturer/connectivity-specific training, as well as any other certifications necessary to purchase and install the specified products.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

D. Color Selection List

1. Provide a list of all communications equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to wall plates, data jack inserts, decora style devices, and decora cover plates.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Communications Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device's color and require that the Contractor replace it at no cost to the Owner.

E. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

F. Shop Drawings in addition to requirements in Section 27 00 00:

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

    a. Floor Plans: Include device/equipment locations, cable routes, MDF/MER and IDF/TR zoning maps, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

    b. Equipment rack elevation details

    c. Elevations of telecommunication room walls with planned mounted equipment

    d. Outlet faceplate details for all outlet configurations, sizes, and cable types

    e. Overhead telecommunication room enlargements, providing dimensions of room and clearance for maintenance and operation

f. A labeling plan must be submitted to and approved by the Owner prior to installation, and the completed labeling must meet the approval of the Owner. EIA/TIA-606 standards are to be met.

1.07 Construction Progress Submittals

A. Final Patch Cord Schedule

1. Provide a final schedule of proposed patch cords for Owner review. The list shall include columns for each of the following: Intended use (location & device type), length, color, cable rating (plenum, indoor/outdoor, etc.), shielded or unshielded, and quantity.

2. Patch cords listed in the pre-construction submittal shall be considered placeholders only. Review of the pre-construction submittal does not indicate approval of the patch cords and does not exempt the Contractor from providing this later patch cord schedule for final review.

B. Communications Labeling Scheme

1. Provide an example of each type of cable or equipment label for Owner review. Examples include standard data outlets, decora data outlets, surface mount interface boxes, horizontal cable runs, Category 6/6a patch panels, voice patch panels, fiber patch panels, data racks, and grounding busbars.

C. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for requirements.

1. Data cable test results

2. USB flash drive containing:

a. As-built drawings (CAD format)

b. As-built drawings (PDF format)

c. Detailed test results in original tester format (e.g. Fluke Linkware)

d. Detailed cable test results in PDF format

3. Warranty certification from connectivity manufacturer

1.09 Delivery, Storage, and Handling

A. Contractor shall be responsible for all materials until completion of Project.

B. Cable shall be stored according to manufacturer's recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.

C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the

cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor's expense.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Labels

A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady "I.D. Pro" or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

B. Characters on all labels shall be black printed on a white background.

C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

2.03 Labels for Backbone Cabling

A. Labels used to identify fiber optic cable or innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads "CAUTION Fiber Optic Cable" and includes blank spaces for adding (1) fiber count and (2) destination information.

B. Labels must be rigid vinyl, self-laminating, slotted for fastening with nylon ties and intended for long-term outdoor use.

C. Manufacturers:

1. XpressTags TG-2109

2. Panduit PST-FOBLNK

3. VIP Products' "Caution Write-On Coverall Tag"

4. Or approved equal

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

B. The Contractor shall provide to the Owner a manufacturer's 15-year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive the numbered certificate from the manufacturing connectivity hardware (patch panels, jacks, patch cords, 110 blocks, etc.) company registering the installation. This warranty shall include all labor, materials, and travel time.

C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568 and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568 ISO/IEC IS 11801 for fiber links/channels for a fifteen (15) year period. The warranty shall apply to all passive structured cabling system components.

D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568 or ISO/IEC IS 11801 component and link/channel specifications for cabling. Such warranty shall apply for a minimum of a fifteen (15) year period.

E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

3.04 Examination

A. Verification of Conditions: Contractor shall examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.

B. Contractor shall verify that cable lengths comply with published standards.

C. Contractor shall notify Owner of any proposed installation which is expected to exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner regarding alternative routing or location of cable.

E. Contractor shall not proceed until unsatisfactory conditions have been corrected.

3.05 Spare Parts

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

3.06 Installation Requirements

A. Refer to Section 27 00 00 for additional requirements.

3.07 Cooperation

A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.08 Labeling

A. General

1. The Contractor shall match the Owner's standard labeling scheme.

2. Clean surfaces before attaching labels.

3. Install all labels firmly and permanently. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

B. Labeling of Cabling and Termination Components

1. Backboard and Equipment Racks

a. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.

b. Character height shall be 1-inch (minimum).

2. Cabling

a. Horizontal cables shall have a machine generated wrap around cable label within 4” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25” (minimum).

b. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5” (minimum).

3. Fiber Optic Backbone, Riser Cables, and Termination Components

   a. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

   b. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

4. Standard Information Outlet (SIO) Faceplates

   a. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).

   b. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

   c. Station cables shall be labeled within two inches of the cable end.

5. Surface Mount Boxes

   a. All surface mount boxes shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, and the data port number(s) on the data patch panel(s).

   b. Surface mount boxes are to be labeled (1) in the designation window of the box, (2) on each cable terminated at that location, and (3) on the ceiling grid directly below the box when installed above accessible ceiling.

   c. Cables shall be labeled within two inches of the cable end.

6. Data Patch Panels

   a. All data patch panels shall be clearly labeled indicating the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48 machine labeled above each port by the manufacturer), ports will also be labeled with the outlet location (labeled below the port). Each

telecommunication room shall start with data patch panel 'A' and continue through the alphabet.

b. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

c. Refer to Telecommunication "T" Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

7. Fiber Optic Cables and Termination Components

   a. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.

   b. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

   c. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

8. Labeling for Backbone Fiber and Outside Plant

   a. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read.

   b. Descriptive identifiers shall include a combination of the following:

      i. Identify the item that the fiber is traveling to by name.

      ii. Identify the fiber count and mode.

      iii. Identify the direction the majority of the fiber optic cable travels from a handhole/manhole.

   c. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat or ultraviolet light) and should have a design life equal to or greater than that of the labeled component.

   d. Each cable shall be labeled within 18 inches from the end of the splice enclosure.

e. Each cable is to be labeled within 18 inches from the end of the conduits. In addition, labels shall be affixed to conduit at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of “HUB Location one-Location two- fiber strands#”. For example, cable sheath from the Campus MDF to Manhole 8C would be labeled as "Campus MDF-MH8C-12.” For example, in the assist handholes/manholes, the cables shall be labeled as “HH South to MH08 North for Veterans.”

f. The following provisions shall apply to labeling Fiber Distribution Components:

i. Label the front of the patch panels with the fiber optic cable number, direction, and fiber count.

ii. Each fiber optic strand shall be labeled with a unique identifier at the LC coupler in the fiber optic patch panel. Connectors shall be labeled on the identifying sheets on the front of the fiber optic patch panel.

iii. Label the front of the splice panels with the fiber optic cable number, direction, and fiber count.

iv. Label splice trays/splice wheels with the cable ID and fiber numbers contained in the tray/wheel.

9. Ground System Labeling

a. Label attachment device at busbar.

10. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

3.09 Testing and Acceptance

A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum

of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

F. The Contractor shall provide Consultant with test results and descriptions of the testing methodology, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.

G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.

H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.

I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.

   1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.

   2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.10 Fire Stopping

A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

End of Section

Section 27 05 26 – Grounding and Bonding for Technology Systems

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. Provide (1) Telecommunications Main Grounding Busbar (TMGB/PBB) in the MDF

C. Provide (1) Telecommunications Grounding Busbar (TGB/SBB) in each IDF.

D. Provide a Telecommunications Bonding Backbone (TBB), sized appropriately for the distance, stranded green insulated copper conductor in a star topology between the TMGB/PBB and each TGB/SBB in each building.

1. When IDFs are stacked a single TBB can be daisy-chained between TGBs/SBBs back to the TMGB/PBBs.

E. Provide an Equipment Bonding Conductor (EBC), sized appropriately for the distance, green insulated conductor from the TMGB/PBB or TGB/SBB as applicable to each cable runway system, equipment rack, cabinet, lightning protector, or multi-pair cable with a metallic element.

1. Install an appropriately sized stranded green insulated copper conductor from the TMGB/PBB to the main building electrical service ground in each building.

2. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room, each TGB/SBB and TMGB/PBB shall be bonded to the vertical steel metal frame using a minimum #6 AWG conductor. The connection to building steel does not eliminate the requirement for the TBB or BC to the service ground.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. IEEE C2 - National Electrical Safely Code

B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

C. ANSI/TIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications

D. NFPA 70E - Standard for Electrical Safely in the Workplace

E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

F. UL 467 - Standard for Grounding and Bonding Equipment

G. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Grounding and Bonding Cable

A. The grounding and bonding cable shall be stranded copper conductors.

B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used within the same facility.

D. Provide a Grounding Equalizer Conductor, sized appropriately for the distance, stranded green insulted copper conductor to interconnect multiple TBBs on the top floor and every 3rd floor when required by ANSI J-STD-607-D.

E. When exceeding 13 feet the conductors shall be sized at 2 kcmil per linear foot of conductor length up to a maximum of 750 KCML.

2.03 Grounding and Bonding Busbars

A. Primary Bonding Busbar (PBB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 20”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

B. Secondary Bonding Busbar (SBB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 12”
4. Insulated from its support

5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

C. Horizontal Equipment Rack or Cabinet Busbar

1. Mounts to standard 19” Rack or Frame
2. Capacity: 6 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

D. Vertical Equipment Rack or Cabinet Busbar

1. Mounts to vertical rail or inside of cabinet in 19” or 23” equipment rack or frame.
2. Capacity: 9 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

2.04 Mechanical Connectors

A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. Connectors shall meet or exceed UL 467.

2.05 Compression Lugs

A. Shall be UL & CSA listed

B. Shall meet or exceed the performance requirements of IEEE 837, latest revision

C. Compression type

D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.

E. Shall be electro-tin plated

F. Lugs shall be 2-hole. Single hole lugs are not allowed

G. Long barrel that will allow a minimum of two crimps with standard industry colors

H. Each connector shall be filled with an oxide-inhibiting compound

I. Crimped with a compression, tool and die system, according to manufacturer's recommendation

2.06 Taps

A. Connections to the Conductor shall be made with irreversible compression connectors

B. Shall be UL & CSA listed

C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap

D. Crimp according to manufacturer's recommendation

Part 3 - Execution

3.01 General

A. Install products in accordance with manufacturer's recommendations.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Mechanical connections shall be accessible for inspection and maintenance.

D. No insulation shall be installed over mechanical ground connections.

E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.02 Resistance Measurement

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.03 Telecommunications Bonding Backbone (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:

1. Be connected to the PBB & SBB.

2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG.

3. The TBB conductors shall be installed and protected from physical and mechanical damage.

4. The TBB conductors should be installed without splices.

    a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.

    b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

3.04 Backbone Bonding Conductor (BBC)

A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.

B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.

C. A metallic cable shield shall not be used as a GE.

3.05 Telecommunications Equipment Bonding Conductor (TEBC)

A. Connects the PBB/SBB to equipment racks and cabinets.

B. Shall be a continuous copper conductor that shall be sized per the length of cable.

C. Shall be separated from ferrous materials by 2” or be bonded to the ferrous metal.

D. May be routed within cable trays or suspended 2” under or off the side of the cable tray or ladder rack.

E. Shall be supported every 3ft.

F. 8” minimum bend radius.

G. May come cross other cable groups at a 90 degree angle only.

H. A metallic cable shield shall not be used as a TEBC.

3.06 Rack or Cabinet Bonding Conductor

A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the PBB, SBB or underfloor ground mesh network.

B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest PBB or SBB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.

3.07 Electrical Distribution Panel (EDP)

A. The AC EDP serving the Telecommunications Room shall be bonded to the PBB or SBB using a minimum of a 6 AWG cable.

B. A qualified electrician shall make all connections within an AC electrical distribution panel.

3.08 Optical Fiber Conductive Cables

A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.

3.09 Conduit and Sleeve Bonding

A. All conduits and sleeves entering a telecommunications room shall be grounded.

3.10 Ladder Rack and/or Cable Tray

A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close PBB or SBB as practical.

B. Maintain an 8” minimum bend radius on the TEBC.

C. Keep a 2” separation from other cables both power and telecommunications.

D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.

E. Drill two holes as required to accommodate the 2-hole compression lug.

F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.

G. Attach straps to the runway using stainless steel hardware sized for the lug holes.

H. Wipe off any excess antioxidant after installation of the lug.

3.11 Building Steel

A. Each ground bus bar shall be bonded to building steel.

B. Remove any paint or fire stopping spray from the building steel.

C. Provide the appropriate bonding connector to connect to beams, trusses or other types of structure.

3.12 Labeling

A. Refer to Section 27 05 00 for additional requirements

B. Each grounding/bonding cable shall be labeled at the PBB or SBB.

C. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

D. Mechanical connectors shall be clearly marked with the catalog number, conductor size, and manufacturer.

E. Compression lugs shall be clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.

3.13 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

3.14 Training

A. Refer to Section 27 00 00 for additional requirements.

3.15 Warranty

A. Refer to Section 27 00 00 for additional requirements.

End of Section

Section 27 05 28 – Pathways for Technology Systems

Part 1 - General

1.01 Scope

A. Refer to Section 27 00/05 00 for additional project scope information.

B. Conduit and pathway mockup are required for Classrooms and other spaces having multiple similar instances i.e., Conference rooms, Collaboration spaces, Offices, PLC etc. Conduit pathway and rough-in installation of the similar spaces shall not commence until mockup rooms have received written approval from Owner's design manager and consultant.

C. Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill ratio.

D. Different media types and colors shall be secured and separated within pathways.

1. Backbone Fiber.
2. Backbone Copper.
3. Horizontal Data (Blue).
4. Horizontal Wireless (Green).
5. Horizontal Security (Orange).

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Wire Basket Tray Runway

A. Pathways and cable trays shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill ratio.

1. Cable tray should not be higher than 12-feet A.F.F.

B. Main cable pathways shall be wire basket cable tray from the MDF and IDF rooms for a minimum of 20-feet before transitioning to cable hooks.

C. Cable tray shall have a 3-inch minimum clearance from the ceiling tile to the bottom of the cable tray and 8-inch minimum clearance from the top of the cable tray to HVAC units, HVAC duct, heating ducts, and heating equipment, etc.

D. As shown on the Project Drawings, the Contractor shall provide and install sufficient wire basket tray runway systems to support horizontal cable bundles.

E. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket tray runway systems.

F. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

G. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

H. Contractor shall ensure that all straight section longitudinal wires are installed with no bends, kinks, or twisting.

I. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing to prevent damage to cables and injury to installers.

J. All fittings shall be field formed as needed.

K. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

L. Wire Basket Tray shall be grounded only at the Telecommunications Room ground bus bar.

M. Cable Drop Out/Waterfall

    1. Where cables bundles transition from tray to tray or tray to conduit or sleeve of varying elevations the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 30% future growth.

N. T-sections of tray shall be made using T-section fittings.

O. Straight section splices shall be made using splice plates.

P. Wire basket runway supports shall be of the trapeze hanger type.

Q. Trapeze hangers shall be supported by 3/8 inch diameter rods.

R. Tray shall have an electro zinc finish or a flat Black finish wherever finished installation will be visible to end users.

S. Accessories (connectors, splice plates…) shall be painted to match tray finish.

T. Contractor shall refer to project drawings for cable tray sizing.

U. Different media types and sheath colors shall be secured and separated within pathways.

1. Backbone Fiber.
2. Backbone Copper.
3. Horizontal Data (Blue).
4. Horizontal Wireless (Green).
5. Horizontal Security (Orange).
6. Other systems or trades should not use the same sheath color as listed above.

V. Manufacturer: Cable trays and accessories shall be of one of the following manufacturers

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.03 Cable Hook Systems

A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.

B. Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill ratio.

C. Cable hooks shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

D. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.

E. Cable hooks shall be Category 6a or better rated.

F. Follow manufacturer’s recommendations for allowable fill capacity for each size of cable hook.

G. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

H. Cable hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray. Installed no higher than 3-feet above ceiling grid.

I. Cable hooks shall be installed utilizing appropriate hardware to support, join and attach cable hooks to structures.

J. No grid wire shall be utilized for support. Cable hooks shall be mounted to the structure.

K. Cable hooks shall:

1. Have a flat bottom and provide a minimum of 1 5/8" cable bearing surface.
2. Have 90-degree radiused edges to prevent damage while installing cables.
3. Be designed so the mounting hardware is recessed to prevent cable damage.
4. Have a steel cable latch retainer to provide containment of cables within the hook.
5. Have a retainer that shall be removable and reusable.
6. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.

L. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

M. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

N. Preferred method of supporting cable hooks is to anchor cable hooks to above ceiling walls.

O. Cable hooks for corrosive areas shall be stainless steel, AISI type 304.

P. Cable hooks shall be Panduit J-hooks.

2.04 Surface Raceway

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, where telecommunications outlets are to be located in areas where the walls cannot be fished, the station wire serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. When power is provided in the surface mounted raceway a dual-channel surface mounted raceway shall be provided to separate the power from the structured cabling.

D. The use of surface mounted raceway shall only be considered when no option is available to install the workstation outlets flush in the wall and shall be approved by the FBISD Design Manager during the design.

E. The raceway shall originate from a surface mounted box located off the floor, be attached to the wall, and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for wall-mounted phone locations shall originate from a surface mounted box with the top of the box located 48" off the floor.

F. Raceway finish shall match finish of project electrical raceway. All fittings including but not limited to extension boxes, elbows, tees, and fixture boxes shall match the color of the raceway.

G. Telecommunication outlet faceplates shall match electrical faceplate standards for finish.

H. The raceway and all system devices shall be UL listed, exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0, and be Category Compliant as defined by TIA/EIA 568.

I. Raceway turns or bends shall conform to manufacturer specifications or recommendations and industry best-practices for UTP and fiber optic cable minimum bend radius.

J. Non-Metallic raceway systems:

1. Non-metallic surface raceway shall have an adhesive-applied base and have a hinged snap-on cover. The raceway shall be manufactured of natural PVC compounds.

2. The raceway system shall be made up of the following components:

a. Raceway channel shall be Panduit LD5.

b. Surface mount outlet boxes shall be Panduit JBX3510EI-A.

c. Dropped ceiling connectors shall be Panduit DCF5EI-X or DCEFXEI-X.

d. Right angle fittings shall be Panduit RAFC5EI-X.

e. Coupler fittings shall be Panduit CFX5EI-X.

K. All raceway systems shall be installed complete as specified herein and in manufacturer recommendations.

2.05 Cable Pathway Sleeves

A. The Contractor shall only provide when re-enterable sleeves are not possible.

B. The Contractor shall provide all necessary wall penetration for cable pathways whether or not specifically shown on Project Drawings.

C. All wall penetrations shall have metallic sleeve(s) as required to maintain a maximum 40% fill ratio and capacity for 30% future growth.

D. All sleeves shall be properly firestopped by this Contractor.

E. Contractor shall provide all core holes, pathways and sleeves (minimum 1.25" c).

F. Contractor shall install non-metallic threadless insulating bushings on end of all conduits.

G. Conduit Core Holes and Sleeves thru Floor: For all floor penetrations, Contractor shall provide IMC conduits with threaded steel couplings set flush with finish floor. Extend 6” above finish floor with IMC before any termination.

H. Provide spare conduits at bulk heads, fur downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.

2.06 Re-Enterable Firestop Sleeves

A. Device modules comprised of steel pathway with self-adjusting intumescent foam pads/membrane allowing 0 to 100 percent visual cable fill.

B. Refer to the drawings for required sizes. If not specifically identified, utilize 2” or greater as required for cabling counts with 20% additional capacity for future growth.

C. Manufacturer:

1. STI EZ Path
2. Hilti Speedsleeve
3. Or approved equal

2.07 Metal Conduits and Fittings

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-E.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
    a. Fittings for EMT:
        i. Material: Steel
        ii. Type: Setscrew
6. Expansion Fittings: Steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

B. All metal conduits must have nylon bushings installed and be supplied with pull string.

2.08 Outlet Boxes

A. General Requirements for Outlet Boxes

1. Comply with TIA-569-E.

B. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16'' thick.

C. Flush Wall Mounted Workstations (Typ.)

1. Provide a 4 11/16” by 4 11/16” by 2-1/8” double-gang back box with single-gang mud ring at 18 inches above the finished floor and at appropriate height for wall mounted phones and above-counter and millwork locations.

2. Provide a minimum of (1) 1-inch conduit from the double-gang box to above accessible ceiling in the room where double-gang box is located. If ceiling is not accessible, install conduit to nearest accessible ceiling.

3. Terminate the conduit above accessible ceiling and install nylon bushing and pull string.

D. Floor Mounted Workstations

1. Provide a floor box or poke-thru specifically designed for the application and environment adequately sized to accommodate the quantity of installed horizontal data cables.

2. Provide a minimum of a (2) 1-inch conduits from the floor box to above accessible ceiling.

3. When cabling is going below grade, the appropriate OSP rated cable shall be utilized with an industry standard transition to plenum rated cable made overhead at the appropriate location with identification label attached to the ceiling grid.

E. Modular Furniture Workstations

1. Provide a rough-in pathway designed according to the furniture type, quantity of cables, and location as required for each furniture system.

F. Above Accessible Ceiling

1. For ceiling-mounted outlets above accessible ceiling such as Wireless Access Points or IP Cameras, no rough-in is required.

2. The data cable will terminate into a surface-mount box secured to the structure above the accessible ceiling. No higher than 3 feet above ceiling grid preferred is 1 foot.

3. No outlets shall be provided above an accessible ceiling that is greater than 12-ft above finished floor. If the accessible ceiling is greater than 12-ft above finished floor, the outlet shall be provided on the wall at 12-ft above finished floor, so it remains easily accessible from a standard ladder.

4. Consultant/designer to provide detail showing coordination with architectural model.

G. 5.5 Exterior WAP locations should be coordinated and a detail/elevation showing wall and canopies should be provided.

H. Metallic outlet boxes shall be equipped with single device cover (or two-device cover where needed).

I. Where installed in plaster, gypsum board, etc., covers shall be raised to compensate the thickness of the wall.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Where metallic outlet boxes are to be empty for future use, blank covers shall be used.

2.09 Painting

A. The Contractor is responsible for painting all exposed pathway, boxes, fittings, etc. The paint shall match the surrounding conditions and may change mid-run.

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Wire Basket Tray Runway

A. Basket tray shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of wire basket runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing wire basket runways to permit access for installing and maintaining cables.

D. Test wire basket runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

3.05 Cable Hook System

A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.

B. Cable bundles consisting of fewer than 10 cables may be supported by single J hooks.

C. All cable support in the main cable path shall be installed every four feet. Small cable bundles (under 25) not in the main path may be supported every five feet.

D. A sag shall be maintained between supports of 6”, to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.

E. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.

F. Cable bundles including voice/data cabling shall not have plastic cable ties.

G. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

3.06 Surface Raceway System

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, if a telecommunications outlet is required in an area where the walls cannot be fished, the station cable serving these outlets shall be covered with raceway. No exposed cable shall be permitted within offices, laboratories, and conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor and be attached to the wall and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for a wall-mounted location shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Minimum bend radius shall be adhered to for UTP and fiber optic cable.

E. Where raceway is to be installed on painted, smooth, finished surfaces, the Contractor shall clean surface prior to installing raceway.

F. Where non-metallic raceway is to be installed on non-smooth surfaces such as wallpaper, unpainted brick, concrete, etc., the Contractor shall use flat-head screws in addition to the adhesive backing to fasten channel to surfaces.

G. Where Contractor is required to install metallic raceway, the raceway base shall be installed using flat-head screws and following all manufacturer's recommendations.

H. Where new outlet locations are indicated on Project Drawings as having existing Wiremold™ type raceway, the Contractor shall remove existing raceway from wall and install new specified raceway to cover any damage or markings caused from removing existing raceway product.

I. All surface raceway shall be mounted level and plumb. Where the Owner considers raceway channels to be installed unsatisfactorily, the Contractor shall remove and replace necessary channels at no additional cost to the Owner.

J. Suitable insulating bushings and inserts shall be used at connections to outlets and corner fittings. Dropped ceiling end fittings shall be utilized where raceway channel connects to dropped accessible ceiling tile. In rooms with drywall ceilings, open ceilings, or non-accessible ceilings, the Contractor shall extend raceway to the nearest location, hallway, or corridor that has accessible ceiling cavity. All cables shall be concealed.

3.07 Pathway Applications

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT

2. Concealed in Ceilings and Interior Walls and Partitions: EMT

B. Minimum Pathway Size for Data: 1-inch trade size. Cable fill shall not exceed a 40% fill ratio.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

3.08 Installation

A. Comply with NECA 1, NECA 101, and TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. All conduit penetrations shall comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.

I. Conduits shall be routed in the most direct route, with the fewest number of bends.

J. There shall be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.

K. There shall be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.

L. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.

M. Stub-ups to Above Recessed Ceilings:

    1. Use EMT for pathways.

    2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

O. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

R. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

3.09 Outlet Boxes

A. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

B. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

C. The approximate locations of the outlets are indicated on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

E. Horizontally separate boxes by a minimum of 12'' mounted on opposite sides of walls so they are not in the same vertical channel.

F. Outlet boxes installed back to back in fire-rated walls shall be separated horizontally by a minimum of 24''.

G. Install all outlet boxes in finished areas flush with the wall. Maintain ¼'' or less space between outlet box front and finished wall surface.

H. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

I. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

J. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

K. Any surface boxes shall have rounded corners and edges. Surface boxes must be approved by Owner prior to installation.

3.10 Riser Conduits

A. Conduits entering equipment rooms shall be reamed or bushed and terminated not more than 4" from a wall and within 12” of room corners.

B. Conduits entering equipment rooms from below floor shall be terminated not more than 4" above finished floor.

C. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200 pound test.

D. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.

E. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).

3.11 Sleeve-Seal Installation for Communications Penetrations

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.12 Firestopping

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

End of Section

Section 27 05 37 – Firestopping for Technology Systems

Part 1 - General

1.01 Scope

A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.

B. Refer to Section 27 00 00 for additional project scope information.

1.02 Related Work

A. Division 7 - Firestopping

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 05 28 – Pathways for Technology Systems

F. Section 27 05 37 – Firestopping for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 13 00 – Communications Backbone Cabling

I. Section 27 15 00 – Communications Horizontal Cabling

J. Section 27 18 00 – Communications Labeling and Identification

K. Section 27 40 00 – AV/Multimedia General Requirements

L. Section 27 41 00 – Audio Visual Systems

M. Section 27 51 00 – Distributed Communications Systems

N. Section 27 60 00 – Physical Security General Requirements

O. Section 27 62 00 – Electronic Access Control System

P. Section 27 64 00 – Video Surveillance System

Q. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. ANSI/TIA-EIA-569-D “Telecommunications Pathways and Spaces”

B. ASTM E90, “Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements”.

C. ASTM E814, “Fire Tests of Through Penetration Firestops”.

D. ASTM E1725, “Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components”.

E. CAN/ULC S115, "Standard Method of Fire Tests of Firestops Systems."

F. UL 1479, “Fire Tests of Through Penetration Firestops”.

G. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.

H. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code.

I. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

J. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 General Performance Requirements

A. Fire rated cable pathway devices shall be used in fire-rated construction for all low-voltage or optical fiber raceways. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
2. Be tested for the surrounding construction and cable types involved.
3. Re-enterable firestop pathway shall have UL Systems permitting cable loads from zero to 100% visual fill.
4. Re-enterable firestop pathway shall be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
5. Pathways shall be engineered such that two or more devices may be ganged together for additional cable capacities.
6. 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.
7. Size as shown on the drawings or as required when not specifically identified.

B. Non-rated cable pathway devices shall be used in non-fire-rated construction such as smoke partitions for all low-voltage and fiber optic cabling where frequent cable moves, adds and changes may occur. Such devices shall:

1. Limit the movement of smoke and sound of wall and or floor penetrated.
2. Restore the STC Rating of the penetrated assembly.
3. Provide L Ratings of greater than 1 CFM when empty and greater than 2.5 CFM at all other loading up to 100 percent.
4. Accommodate cable loads from zero to 100% visual fill.
5. Be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
8. 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. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

D. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.

E. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.03 Materials

A. General: Use only products that have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.

B. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSS or LCI Sealant.

b. Hilti

C. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSP Putty.

b. Hilti

D. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSB Pillows.

b. Hilti

E. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) EZ-Firestop Grommets.

b. Hilti

F. Fire-Rated Cable Re-Enterable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads or fabric ring allowing 0 to 100 percent cable fill.

1. Provide with radius control modules (waterfalls) by pathway manufacturer.

2. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

b. Hilti Speed Sleeve

G. Smoke and Acoustical Pathways: Device module comprised of a nonmetallic pathway with integral self-adjusting smoke and sound sealing system for cable penetrations through non-fire-resistance rated wall or floor assemblies

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) EZ-PATH Smoke & Acoustical Pathway.

b. Hilti

H. Protective Wrap: Endothermic Wrap incorporating foil scrim for protection of cable pathways, through-penetration and membrane-penetration firestopping, Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), or Cable Trays.

1. Acceptable Manufacturers:

a. Specified Technologies, Inc. (STI) E-Wrap™ Endothermic Wrap

b. Hilti

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Installation

A. Install systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified or required.

B. Comply with manufacturer’s instructions for installation of products.

C. Place system stickers on each side of wall penetrations.

D. Place a reproduction (photo copy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the section of the system description that list the allowed cable types.

E. Do not install products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

F. Do not install products when substrates are wet due to rain, frost, condensation, or other causes.

G. Do not use materials that contain flammable solvents.

H. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to requirements.

I. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

3.05 Schedules

Penetrant Type	Concrete Floor	Concrete Wall	Gypsum Board Wall
Blank Opening	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	W-L-0020, W-L-0034
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits and Raceways	C-AJ-2140, C-AJ-2292, F-A-2186, F-A-2210, F-A-2225	C-AJ-2038, C-AJ-2108, C-AJ-2578, C-AJ-2586, W-J-2018, W-J-2076	W-L-2059, W-L-2074, W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015, F-A-3021, F-A-3054	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099,W-J-3124, W-J-3150, W-J-3180	W-L-3219, W-L-3248, W-L-3287, W-L-3356, W-L-3377, W-L-3378, W-L-3379, W-L-3390
Cable Trays	C-AJ-3317, C-AJ-8181, C-AJ-4029, F-A-3015, F-A-3037	C-AJ-8181, W-J-4021, W-J-4022, W-J-4033, W-J-3098, W-J-3145, W-J-3158	W-L-3218, W-L-3271, W-L-3286, W-L-3306, W-L-4008, W-L-4029, W-L-4043, W-L-8073

End of Section

Section 27 11 00 – Communications Equipment Rooms

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks
2. Horizontal and backbone cable terminating equipment
3. Telecommunications grounds and related components

C. Full system functionality must be maintained during additions and renovations in unaffected areas.

D. Remove and disconnect abandoned equipment. Remove any abandoned cabling and patch all penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

E. A minimum of one IDF/MDF closet per floor to house equipment/cable terminations and associated cross-connect cable located near the center of the area being served but neither next to a restroom nor have, any plumbing in, above, adjacent to, or through the room.

1. Closets should be stacked where possible
2. Minimum room sizes are as follows: MDF to be 150 square feet (10’ X 15’) and IDF to be 100 square feet (10’ X 10”) and to have walls lined in 3/4" fire rated plywood.
3. No ceiling in the MDF/IDF room.
4. Lights to be in front and behind the racks
5. MDF/IDF penetrations use an EZ path system. Number and size of EZ Path should be determined by the number of cables going into the room plus 30% growth.
6. IDF, no patch panels below middle horizontal wire manager, new relay rack will need to be added. Data cables terminate on third rack. (a two relay rack layout changes to a three-relay rack layout).
7. MDF/IDF door shall swing out into corridor not into room.
8. Floor mounted HVAC Unit shall be coordinated with MEP, Architect, and FBISD IT

9. HVAC piping should be 6 inches off the wall. HVAC piping to the outside unit should not go through over or around the network cabling or equipment.
10. If HVAC Unit is to be located near door it should be blocked by a furr out by the door

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 General

A. Category 6 and Category 6A cables shall be terminated with the T568B sequence.

B. Each “system” shall be provided with a separate patch panel

1. Data - Category 6

2. Wireless - Category 6A

3. Security Camera - Category 6

2.03 Category 6/6A Patch Panels

A. Cables shall be terminated at the telecommunication closets on high-density modular patch panels incorporating Category 6 jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet specified.

B. Patch panel configuration shall be 48 ports unless noted otherwise.

C. Provide patch panels and/or available ports to support 30% growth for Each “system.”

D. Patch panels shall be angled.

E. The patch panel shall exceed ANSI/TIA 568.2-D Category 6 component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

F. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

G. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

H. The patch panel shall have color-coded designation strips to identify cable count.

I. Manufacturers:

1. Panduit (Mini-Com CPPA48FM6VNSBL)

2. Or FBISD approved equal

2.04 Voice Patch Panels

A. At the MDF and each IDF the voice backbone cables originating from the primary distribution point shall be terminated on rack mounted voice patch panels.

B. Backbone cables 25-pair or less shall be terminated on 24-port patch panels and backbone cables greater than 25-pair shall be terminated on 48-port patch panels.

C. Manufacturers:

1. Panduit

2. Or FBISD approved equal

2.05 Fiber Optic Patch Panels

A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.

B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, and FC by changing panels on which connector couplings are mounted.

C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.

D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.

E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.

F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.

H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.

I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.

J. Where singlemode fibers are installed, the fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtails") or (2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering (such as an Aramid reinforced tube, for example) with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.2 dB.

K. Fiber optic patch panels shall be Panduit in TR/IDF and PCH-4U in MDF or Server Rooms or FBISD approved equal.

L. 50-micron LC adaptor panels shall be Panduit or FBISD approved equal.

2.06 Cable Management System

A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

B. 2-Post Equipment Racks

1. The MDF shall be equipped with a minimum (4) two-post equipment racks with (5) vertical wire managers.

2. The IDF shall be equipped with a minimum (2) two-post equipment racks with (3) vertical wire managers.

a. Rack (1) One: will all ways be on the left when facing the front of rack, will have the fiber enclosure and voice tie(s). in some cases, you will be entering the room and seeing the back side of racks.

b. Rack (2) Two: will have security camera, wireless access point, and data cables

    i. No patch panels below middle horizontal wire manager, new relay rack will need to be added. Security Camera, and Wireless Access Point cables terminate on rack (2) two and Data cables terminate on (3) third rack. (a two relay rack layout changes to a three-relay rack layout).

    ii. When a (3) Three rack system is required, IDF room size will need to increase in size, 10’ X 13’

3. Racks shall be black aluminum Standard Equipment Racks with EIA 19-inch rails, 84-inches high (45 RMU) and rack mount unit markings on the rails from top to bottom.

4. Racks shall be bolted to the concrete floor and to the overhead cable runway utilizing manufacturer-recommended hardware and methods.

5. Racks shall have 4-ft clear in front and back of all racks and on one side of the row of racks.

    a. 3 feet minimum from front of rack to first item (equipment panel or Wall). the preferred is 4 feet.

6. The top half of the equipment racks shall be reserved for cable terminations and the bottom half of the racks shall be reserved for equipment.

7. MDF/IDFs shall have (1) wall phone directly in front of the racks and (1) camera viewing the entry door.

    a. Channel uprights shall be spaced to accommodate industry standard 19" mounting and have pass-through holes with smooth edges to protect cables.

    b. Able to support up to 1,500 pounds.

    c. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

    d. Rack shall be supplied with at least 24 spare screws.

    e. Rack shall be supplied with a vertical ground bar and #6 AWG ground lug.

    f. Manufacturers:

        i. Panduit

        ii. Or FBISD approved equal.

2.07 Vertical Cable Management

A. At the telecommunication rooms, vertical cable management shall be furnished and installed to adjacent racks to organize cables on front and rear of telecommunication racks.

B. Vertical cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks.

C. Vertical cable management system shall feature the following:

1. Open cabling section on the rear that provides easy access and routes cable bundles feeding into the back of patch panels and 1 RMU cable guide on the front designed for fanning and managing patch cords.

2. Edge-protected pass-through ports designed for easy routing of cable from front channel to back.

3. Vertical slots along the center separator to allow securing cable bundles neatly with management straps.

4. Door/cover (front only) that is easily opened from the right or left and still easily removed to allow for quick moves, adds, and changes.

5. Movable wire retainers to retain the cables during cover removal.

D. Vertical cable management at the end of rack rows shall be 10”.

E. Vertical cable management between racks shall be 10”

F. Manufacturers:

1. Panduit PR2VD06 / PR2VD10

2. Or FBISD approved equal

2.08 Power Devices

A. All equipment racks shall be equipped with two (2) Owner Furnished / Owner Installed Power Distribution Units (PDU) to be marked BLUE if connected to UPS or RED if connected to wall outlet.

2.09 Shallow Wall Mount Cabinet

A. Where Indicated on Project Drawings, the Contractor shall provide and install a shallow wall mount cabinet to house cable termination panels and network electronics. The Contractor shall also provide and install ¾" plywood backboard for support when mounting cabinet.

B. The Contractor shall coordinate with General Contractor to install power outlet into cabinet.

C. Cabinets housing active equipment shall be equipped with a fan and fan controller.

D. Manufacturers:

1. Panduit 2U Horizontal manager

2. Or FBISD approved equal

2.10 Wall Mount Equipment Cabinet

A. Where indicated on Project Drawings, the Contractor shall provide and install wall mount cabinet to house cable termination panels and network electronics. The Contractor shall also provide and install one (1) ¾" plywood backboard for support when mounting cabinet.

B. The Contractor shall coordinate with Electrical Contractor to install a power outlet into cabinet.

C. Cabinets shall be equipped with fans and thermostatic fan controller.

D. Tempered glass door with lock

E. Sized as necessary to fit the proposed equipment; 36”H minimum.

F. Manufacturers:

1. Chatsworth 12419-7##

2. nVent Hoffman

3. Or approved equal

2.11 Horizontal Cable Management

A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

C. All racks shall be equipped with a minimum of (2) horizontal cable managers with covers.

1. One (1) horizontal cable manager shall be placed on the top of the equipment rack and one (1) horizontal cable manger shall be placed in the middle of the equipment rack.

2. Horizontal cable management shall be 2U.

D. Manufacturers:

1. Panduit

2. Or FBISD approved equal.

2.12 Telecommunication Ground

A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor. Refer to the Grounding and Bonding for Technology Systems specification section.

2.13 Wire Basket Runway Tray

A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All straight section longitudinal wires shall be straight (with no bends).

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded to a Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Provide size as indicated on the drawings.

P. Tray shall have flat Black finish.

Q. Accessories (connectors, splice plates…) shall be painted to match tray finish.

R. Manufacturer:

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.14 Ladder Rack

A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.

B. Ladder Rack shall be a Universal Cable Runway made of 3/8” x 1-1/2” x .065” wall rectangular steel tubing with cross members welded at 12-inch intervals.

1. MDFs shall be provided with a minimum of 18-inch wide Universal Cable Runway. Runway shall be sized per manufacturer fill requirements allowing for 30% growth.
2. IDFs shall be provided with a minimum of 12-inch wide Universal Cable Runway. Runway shall be sized per manufacturer fill requirements allowing for 30% growth.
3. The appropriate Radius Drops shall be installed over the racks or cabinets to provide the proper support for the cabling leaving the Universal Cable Runway and entering the rack/cabinet.
4. The appropriate elevation kits and protective ends shall be installed to properly support the Universal Cable Runways above the equipment racks and protects cables and equipment from damage.

5. Universal Cable Runway shall be installed utilizing appropriate hardware to support, join, or attach sections to structures, and shall be supported at a minimum of 5 foot intervals.

6. A vertical section of cable runway shall be attached to the wall board to manage backbone and service provider cables as they transition from the entrance conduits to the overhead cable runway.

C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.

F. Accessories (connectors, splice plates…) shall be painted to match tray finish.

G. Manufacturers:

1. Chatsworth

2. Cooper

3. Legrand

4. Pentair Hoffman

5. Or approved equal

2.15 Plywood

A. The Contractor shall provide plywood. Plywood shall be installed on all walls within a telecommunications room and other locations as noted.

B. Provide void-free, interior grade, fire rated A-C grade plywood, 3/4” by 48” by 96”, or as indicated.

C. When plywood is required to be painted, the paint shall be UL 723 rated white or gray fire retardant. The plywood’s rating stamp shall be exposed (not painted over) on each sheet. Plywood shall have fire calk around all edges. Provide label including paint manufacturer, date painted, UL listing and name of Installer

D. Plywood shall be mounted vertically starting at 22” AFF to 118” AFF and anchored to all studs.

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Equipment Rack and Cabinets

A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.

D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.

E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications grounding backbone (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

3.05 Wire Basket Tray and Ladder Rack Runway

A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC,

applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.

D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

End of Section

Section 27 13 00 – Communications Backbone Cabling

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications voice, data and video backbone cabling and termination components.

C. Backbone Cabling is the cable and hardware interconnecting telecommunication rooms (TRs), building demarcation rooms, equipment rooms and server rooms. The backbone cabling shall consist of the following cable types:

1. 50-micron Multimode Fiber Optic Cable
2. Singlemode Fiber Optic Cable
3. Multi-Pair Copper Voice Backbone Cable

D. Full system functionality must be maintained during additions and renovations in unaffected areas.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.09 Test Data – Fiber Optic Media

A. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

B. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test.

C. The database for the completed job shall be stored and delivered on USB flash drive. This USB flash drive shall include the software tools required to view, inspect, and print any selection of test reports.

D. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value as defined in this document).

3. The date and time the test results were saved in the memory of the tester.

E. The following general information is to be provided in the electronic database containing the test result information for each link:

1. The identification of the customer site as specified by the end user.

2. The overall Pass/Fail evaluation of the link-under-test.

3. The name of the standard selected to execute the stored test results.

4. The cable type and the value of the ‘index of refraction’ used for length calculations.

5. The date and time the test results were saved in the memory of the tester.

6. The brand name, model, and serial number of the tester.

7. The revision of the tester software and the revision of the test standards database in the tester.

F. The detailed test results data to be provided in the electronic database for each tested optical fiber shall contain the following information:

1. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength, and the margin (difference between the measured attenuation and the test limit value).

G. The link length shall be reported for each optical fiber for which the test limit was calculated.

H. Contractor shall provide accurate as-built Construction Drawings at the site during construction.

I. The Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (".dwg", AutoCAD rel. 2004 and ".dxf") formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

J. The Contractors shall annotate the base Drawings and return to the Consultant in hard copy (same plot size as originals) and electronic (AutoCAD rel. 2004 and ".dxf") form.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Backbone Voice Cabling

A. The voice backbone cable shall link the Main Closet and Telecommunications Rooms serving the building. The cables shall be CMP rated where required.

B. Voice backbone cable shall incorporate 24 AWG solid annealed copper conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.

C. The voice backbone cable shall be sized as detailed on the Drawings.

D. All cables and equipment shall be furnished, installed, wired, and tested by the Contractor.

E. Manufacturers:

1. Belden
2. Berk-Tek
3. General Cable
4. Superior Essex
5. Or approved equal

2.03 Copper backbone

A. Inter-Building

1. Inter-building Backbone Copper Cabling shall be (2) OSP rated Category 5e or Category 6 4-pair 24 AWG UTP home run from the MDF to primary IDF in each of the buildings on the campus.
    a. Terminated one pair per port on the panel.
2. Provide a 10-foot service loop at both ends of each cable using a U-shaped configuration, not a true loop. Cables shall be secured with hook-and-loop tie-wraps in the MDF or IDF.
3. Provide a 10-foot service loop in each manhole or pull box.

B. Intra-Building

1. Intra-building Backbone Copper Cabling shall be (2) Category 5e or Category 6 4-pair plenum rated 24 AWG UTP home run from the MDF to each of the IDFs in the building.
    a. Terminated one pair per port on the panel.
2. Provide a 10-foot service loop at both ends of each cable in a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF.

2.04 Copper Surge Suppression

A. Inter-building backbone copper cabling shall be terminated on wall mounted UL-Listed 12-pair 110DC in/out building entrance terminal equipped with UL-Listed Category 5 5-pin solid state quick acting protector modules

B. The secondary side of the building entrance terminal shall be connected to a rack mounted 24-portpatch panel with (2) plenum rated Category 5e or Category 6 24 AWG copper cable.

2.05 Copper Cable Splicing and Termination

A. No splicing shall be allowed.

B. Inter-building Backbone Copper Cabling shall terminate on wall mounted building entrance terminals (that are properly grounded) and extended to rack mounted Category 5e or Category 6 24-Port punch down panels.

C. Intra-building Backbone Copper Cabling shall terminate on a rack mounted Category 5e or Category 6 24-Port punch down panel.

1. All OSP CAT 6 cables should terminate on the wall to surge protection. Then be extended with Plenum cable run to the rack 24 port punch down panel.

2.06 Fiber Optic General Requirements

A. Inter-Building

1. Inter-building Backbone Fiber Optic Cabling shall be OSP rated 12-Strand Armored OM3/OM4 multi-mode home run from the MDF to the primary IDF in each of the buildings on the campus and dressed with fan-out kits as required.

2. Provide a 25-foot service loop at both ends of each cable using a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF.

3. Provide a 25-foot service loop in each manhole or pull box.

B. Intra-building

1. Intra-building Backbone Fiber Optic Cabling shall be plenum rated 12-Strand Armored OM3/OM4 multi-mode from the MDF to each of the IDFs in the building.

2. Provide a 25-foot service loop at both ends of each cable in a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF and in the cable runway.

2.07 Tight-Buffered Optical Fiber Cables for Indoor Distribution Applications

A. General Considerations

1. The cable shall meet the requirements of the National Electrical Code (NEC) Section 770.

2. For plenum applications, the cable shall meet applicable flame tests: ANSI/UL 910 (NFPA 262-1994).

3. Finished cables shall conform to the applicable performance requirements of Tables 8-6 and 8-7 of the Insulated Cable Consultants Association, Inc. (ICEA) *Standard for Fiber Optic Premises Distribution Cable* (ICEA S-83-596).

B. Cable Construction

1. The coated fiber shall have a layer of Teflon placed between the acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be 900 ±50µm. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass for connectorization or splicing.
2. Cables with 2 to 24 fibers layered aramid yarns shall serve as the tensile strength member of the cable.
3. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.
4. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.
5. The fibers shall be stranded around a dielectric central member.
6. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.
7. The central member shall be over coated with a thermoplastic, when required, to achieve dimensional sizing to accommodate and support the 900 µm buffered fibers.
8. Cables with 24 to 60 fibers shall have unitized riser and plenum constructions.
9. The buffered fibers shall be grouped in six-fiber subunits.
10. The fibers shall be stranded around a dielectric central member in the subunit.
11. Layered aramid yarns shall serve as the tensile strength member of the subunit.
12. A ripcord may be applied between the aramid yarns and the subunit jacket to facilitate jacket removal.
13. The subunit jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.
14. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the subunits. The strength members shall be of a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarns to allow them to be easily separated from the fibers and the subunit jacket.

C. Outer Cable Jacket

1. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets

extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand stresses. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

2. The indoor distribution cable specified herein shall have an interlocking armor made of steel or aluminum. Provide plenum rated cable as required.

3. The indoor distribution cable specified herein shall be non-conductive. Provide plenum rated cable as required.

4. The color of the jacket shall match the jacket color of the optical fiber cable located inside of the cable.

D. Fiber Identification

1. The individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSITIA/EIA-598-B “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

2. When buffered fibers are grouped into individual subunits, each subunit jacket shall be numbered for identification, with the exception of filler subunits where used. The number shall be repeated at regular intervals. The subunit jacket color shall be aqua

3. The outer jacket for all dielectric cable shall be marked with the manufacturer name or UL file number, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall be Aqua

4. Cables shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.

E. Cable Specifications

1. Temperature Range

a. Non-Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC. The installation/operating temperature range for riser cables shall be -20 to +70 ºC. Testing shall be in accordance with FOTP-3.

b. Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC.The installation/operating

temperature range for plenum cables shall be 0 to +70ºC.Testing shall be in accordance with FOTP-3.

2. Compressive Load Resistance

    a. When tested in accordance with FOTP-41, Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 89 N/cm (50 lbf/in) applied uniformly over the length of the compression plate. While under compressive load, the fiber shall not experience an attenuation change greater than 0.4 dB at 1550 nm (singlemode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

3. Cyclic Flexing

    a. When tested in accordance with FOTP-104, Fiber Optic Cable Cyclic Flexing Test, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycle per minute. The fiber shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

4. High and Low Temperature Bend

    a. When tested in accordance with FOTP-37, Fiber Optic Cable Bend Test, Low and High Temperature, the cable shall withstand four full turns around a mandrel at test temperatures of 0 ºC and +50 ºC. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.5 dB at 1300 nm (multimode).

5. Impact Resistance

    a. When tested in accordance with FOTP-25, Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies, the cable shall withstand a minimum of 20 impact cycles for riser cables and 10 impact cycles for plenum cables. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

6. Temperature Cycling

    a. When tested in accordance with FOTP-3, Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components, the change in attenuation at extreme operational temperatures (0 to +50 ºC) shall not exceed 0.3 dB/km at 1550 nm (singlemode) or 0.6 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling.

7. Twist-Bend

    a. When tested in accordance with FOTP-91, Fiber Optic Cable Twist-Bend Test, a length of cable no greater than 2 meters shall withstand 10 cycles of

mechanical twisting and bending around a mandrel 20 times the cable outer diameter. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or 0.4 dB at 1300 nm (multimode).

F. Multimode OM4 (50/125 µm)

1. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAA-A-1997, Detail Specification for 50µm Core Diameter/125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers, unless noted otherwise. Cable shall have the following specifications:

a. Core Diameter: 50 ± 3 µm

b. Core Non-Circularity: ≤5%

c. Cladding Diameter: 125± 2 µm

d. Cladding Non-Circularity: <2.0%

e. Core-to-Cladding Concentricity: ≤ 3 µm

f. Coating Diameter: 245 ± 2 mm

g. Refractive Index Profile: Graded index

h. Numerical Aperture: 0.275 ± 0.015

i. Maximum Attenuation: less than 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm.

2. IEEE 802.3ae Performance: The fiber shall support laser-based 10 Gigabit Ethernet (10GbE) operation for up to 550 meters.

3. Attenuation at the Water Peak: The attenuation coefficient at 1380 nm shall not exceed the attenuation coefficient at 1300 nm by more than 1.0 dB/km.

4. Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2 mm diameter mandrel shall not exceed 0.5 dB at 850 nm or 1300 nm.

G. Manufacturer:

1. Belden

2. Berk-Tek

3. Corning

4. General Cable

5. Or FBISD approved equal.

2.08 Loose Tube Optical Fiber Cables for Outside Plant Distribution Applications

A. The cable shall be all-dielectric gel-free designed for outdoor and limited indoor use for campus backbones in lashed aerial and duct installations.

B. The cable shall be fully waterblocked using water-swellable materials.

C. The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g. "Optical Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.

D. Temperature Range:

1. Storage: -40 to +70C (no irreversible change in attenuation)

2. Operating: -40 to +70C

3. Humidity Range: 0 to 100%

E. F. Maximum Tensile Strength:

1. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation)

2. Long Term: 890 N (200 lb. force)

F. G. Bending Radius:

1. During Installation: 20 times cable diameter

2. No Load: 10 times cable diameter

G. The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

H. Manufacturer:

1. Panduit

2. Or FBISD approved equal

2.09 Outside Plant (OSP) Cable and Penetration Sealant

A. The Contractor shall seal all OSP cable ends with an appropriate sealant.

B. Should not corrode copper and be appropriate for electronics.

C. Should have non-sag properties.

D. Utilize manufacturer recommended product to not void warranties.

E. Manufacturer:

1. Rainbow Technology B-Sealant 79500

2. Or manufacturer approved equivalent

2.10 Fiber Optic Connectors

A. The MM optical connector shall be LC UPC type.

B. The OSP MM optical connector shall be LC UPC type.

C. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the connector ferrule shall be secured with an adhesive.

D. The attenuation per mated pair shall not exceed 0.35 dB (individual) and 0.2 dB (average). Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

E. The connector shall meet the following performance criteria:

1. Cable Retention (FOTP-6) 0.2 dB
2. Durability (FOTP-21) 0.2 dB
3. Impact (FOTP-2) 0.2 dB
4. Thermal Shock (FOTP-3) 0.2 dB
5. Humidity (FOTP-5) 0.2 dB

F. Connectors shall be fusion spliced. Mechanical, quick connect or index-gel based connectors are not allowed.

2.11 Fiber Optic Splicing and Terminations

A. No splicing shall be allowed.

B. All fiber optic cables shall be fusion spliced to factory provided “pig-tail” LC terminated cables and installed in rack mounted enclosures.

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Field Test Requirements for Fiber Optic Cabling System

1. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer’s test report for each reel of cable provided. These test reports shall include the manufacturers on reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.

2. Factory data shall be provided upon request, showing on-the-reel bandwidth performance results as tested at the factory.

3. Every fiber optic backbone link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry

Association (TIA) standard ANSI/TIA/EIA-568-C or by the appropriate network application standard(s), whichever is more demanding.

4. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

5. 100% of the installed cabling links shall be tested and shall pass the requirements of the standards mentioned above and as further detailed in this document. Any failing link shall be diagnosed and corrected at no additional cost to the Owner. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with RFP.

6. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

    a. The manufacturer of the fiber optic cable and/or the fiber optic connectors

    b. The manufacturer of the test equipment used for the field certification

    c. Training organizations authorized by BICSI

7. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-C.1) with a Category 1 light source.

8. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

9. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

10. The fiber optic launch cables and adapters shall be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

11. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

12. Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

13. A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing begins.

14. A representative of the Owner will select a random sample of 5% of the installed links. The results obtained shall be compared to the data provided by the installation Contractor. If more than 2% of the sample results differ in terms of the Pass/Fail determination, the installation Contractor, under supervision of the Owner representative, shall repeat 100% of the testing. The cost of retesting shall be borne by the installation Contractor.

C. Fiber Performance Test Parameters

1. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.

   a. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn

   b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

   c. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode OM4 50/125 µm	850	3.0
	1300	1.5
Singlemode (Inside plant)	1310	0.5
	1550	0.4
Singlemode (Outside plant)	1310	0.4
	1550	0.5

   d. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

   e. Maximum allowable mated connectors_loss = 0.50 dB

   f. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)

   g. Maximum allowable splice_loss = 0.1 dB (when tested bidirectionally)

2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices—i.e., it does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

3. Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred.

4. The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

5. The backbone link (multimode/singlemode) shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.

6. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

8. Multimode backbone links are designed to be used with network applications that use laser light sources (underfilled launch conditions). However, the link attenuation equation has been based upon the use of a light source categorized as Category 1, Overfilled.

9. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Cable Slack

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 15 feet of slack cable (each cable) shall be coiled and secured at each end.

C. A minimum of 50 feet of slack cable (each cable) shall be coiled and secured vertically in handholes/manholes used for installation assistance unless otherwise noted in the drawings.

D. A minimum of 100 feet of slack cable shall be provided whenever fiber splice enclosures are required unless otherwise noted in the drawings. This excess slack shall provide added cable for restorations or reconfigurations without digging up large parts of the cable system.

3.05 Installation Practices for Fiber Optic Cable

A. Fiber optic cable is a high-capacity transmission medium with qualities and characteristics, which can be degraded when it is subjected to excessive pulling tension, sharp bends, and crushing forces.

B. The maximum pulling tension for armored cable is 2,700 Newtons (600 lbs.).

C. Maximum long-term crush forces for armored cable are 100N/cm (57.1 lb./in.).

D. The minimum bend radius for an armored cable during installation and following installation over the life span of the cable must be 20 times (20 x) the cable diameter.

E. The minimum diameter required for pull wheels or rollers should be double the minimum bend radius. The Contractor will be responsible to check manufacturer's specifications for the cable feed-chute, to make sure that the chute's critical dimensions and clearances are compatible with the placing cable. The chute must have a 31-inch minimum radius.

3.06 Cable termination for Fiber Optic Cable

A. All fibers shall be terminated using the specified connector type. No mechanical splice is allowed.

B. All terminated fibers at the Telecommunications Closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

C. All couplings shall be fitted with a dust cap.

D. Fibers from multiple locations may share a common enclosure; however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided that they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g. "insert").

E. Slack of 15 feet in each fiber cable shall be provided as to allow for future re termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30" high workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39") of slack shall be retained regardless of panel position relative to the potential work area.

3.07 Fiber Optic System Acceptance

A. The fiber optic outside plant system will be accepted by the Owner when:

1. All the work has been completed in accordance with the contract and specifications.

2. The system operates in conformance with manufacturer's published specifications.

3. The system has completed a successful performance period. The performance period will begin on the day following the cutover and must continue for 30 consecutive days during which time the system will operate at an average effectiveness level of 99 percent or more. If for any reason this level cannot be maintained, a new 30-day performance period will be initiated. It is not necessary that one 30-day period expire before another performance period begins.

4. The Contractor has certified in writing to Consultant when the cable is installed, operational in accordance with these specifications, and ready for use.

5. The final step in accepting buried cable installation will be a thorough inspection of the entire route from start to finish. The "as-built" drawings must be submitted to the Owner one week prior to final inspection. The drawings will be examined by Consultant's personnel and involved parties for conformance to Consultant's plans, codes, regulations, and general accuracy.

6. The construction area above ground will be inspected to ensure the following:

7. Restoration has been accomplished.

8. Permanent markers have been installed immediately beside the cables.

9. Road bores, if used, are properly completed and will not collapse a portion of the road.

10. Debris and trash have been removed from the site.

11. Other instructions specific to the installation have been completed to the project manager's specifications.

12. All test results should be submitted in hard copy and in usable (MS Word) electronic format and meet specifications.

13. At this time, upon Owner's written acceptance, operations control becomes the responsibility of the Owner.

3.08 Outdoor Fiber Splice Enclosure

A. This work shall consist of installing an Outdoor Fiber Splice Enclosure at the splice handholes/manholes. The locations of the splice handholes/manholes are shown on the drawings

B. Mounting the Outdoor Fiber Splice Enclosure in the splice vault requires a L-bracket to be constructed to fit the opening to the splice handhole/manhole. The objective of this L bracket is to keep the splice enclosure off the floor of the handhole/manhole.

C. Fusion type splices shall be utilized. Mechanical splices shall be prohibited.

D. Fiber optic cable splicing is allowed in locations denoted in the drawings. Additional locations shall require the approval of the Consultant.

E. The Contractor shall adhere to the fiber optic cable manufacturer's methods, commendations, materials, and techniques for splicing.

F. All splicing equipment shall be in good working order, properly calibrated, and meet all industry standards and safety regulations.

G. The fiber optic cable preparation, splice enclosure installation, and splicing shall be accomplished in accordance with industry standards.

H. Mechanical stress and splicing locations shall be minimized by training the fiber optic cable into final position, concurrently observing the minimum bending radii of the fiber optic cable. The minimum bending radii of the fiber optic cable shall be 20 times the diameter of the cable or as per the manufacturer's requirements, whichever is greater.

I. Cleanliness and freedom from contamination shall be strictly observed with respect to splicing materials and joint construction. Upon completion of the splicing operation, all waste material shall be deposited in suitable containers, removed from the job site, and disposed of in an environmentally acceptable manner.

End of Section

Section 27 13 23 – Interbuilding OSP Pathways

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project information.

B. This section describes the products and execution requirements relating to outside plant inter-building backbone cabling, termination and splicing components, pathways, underground enclosures and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks
2. Horizontal and backbone cable terminating equipment
3. Telecommunications grounds and related components
4. Full system functionality must be maintained during additions and renovations in unaffected areas.

C. Requirements in this section apply to all underground conduit used for Telecommunications pathways.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

1.03 Definitions

A. OSP – Outside Plant.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Contractor and/or its subcontractors shall be fully authorized/certified to supply, upgrade, install, configure, provide warranty service, and troubleshoot the proposed equipment.

B. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.09 Close Out Checklist

A. The following checklist shall be confirmed prior to close out approval:

1. All the work has been completed in accordance with the contract and specifications.
2. The system operates in conformance with specifications.
3. The system has completed a successful performance period of 30 days.
4. As-built drawings with GPS coordinates have been submitted.
5. Thorough inspection of the entire route from start to finish has been completed.
6. Restoration has been accomplished.
7. Permanent markers have been installed immediately beside the cables.
8. Debris and trash have been removed from the sites.
9. All test results have been submitted and reviewed.
10. All punch list items have been addressed.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Schedule 80 PVC Conduit

A. 4” PVC Schedule 80 conduit shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784.

B. The conduits shall be supported to permit adequate lineal movement to allow for expansion and contraction of conduit due to temperature change.

C. Conduits shall have no more than the equivalent of (2) 90-degree bends between pull boxes.

D. Conduits shall maintain a minimum bend radius of 6 times the diameter of the conduit for conduits 2-inches or smaller and 10 times the diameter of the conduit for conduits greater than 2-inches.

E. Conduits shall not exceed 40 percent fill ratio.

F. All compound components shall be listed with NSF® and meet the requirements of NSF/ANSI Standard 61-G as suitable for fiber optic infrastructure and is considered Lead Free.

G. The conduit shall be manufactured in strict compliance to ASTM D1785, consistently meeting the Quality Assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality.

H. Any conduit bells shall meet the requirements of ASTM D2672.

I. The conduit must also meet the requirements of NSF Standard 14 and shall bear the NSF mark.

J. All appropriate fittings shall be provided by the contractor to enable proper installation of the conduits per the manufacturer recommendations

K. The contractor shall provide 90^{o}, 45^{o} and 30^{o} elbows. Each elbow shall feature 36" radius plain end. The elbows shall be installed per the manufacturer recommendations

L. The contractor shall use of cement for proper solvent cement joints. The Cement shall be prepared particularly for the manufacturer of the conduits, fittings and elbows

M. The conduits, fittings and elbows shall be manufactured in the USA by an ISO 9001 certified manufacturer.

N. Conduits shall maintain a minimum of 12-inches of well tamped earth or 3-inches of concrete separation between any foreign conduits and/or pipes throughout the entire pathway.

2.03 Service Provider Entrance

A. The conduit, manholes and pull box sizing and construction shall be coordinated with FBISD Design Manager and the applicable service provider(s) on a project by project basis.

B. Provide a diverse pathway for service entrance conduits. Diverse pathways shall enter into the campus 180 degrees from each other.

C. Provide for a minimum of (4) 4-Inch conduits from the MDF Room to the edge of the property Right-of-Way and terminate as required by the service provider(s).

1. (2) 4-inch conduits shall be provided with 3-cell detectable MaxCell innerduct intended for 4-inch conduits.

2. Each innerduct shall have a different color identifier.

D. Where the service provider termination location is unidentified at the time of design, the conduits shall route from the MDF to an adequately sized manhole or pull box at least 30 feet from the building edge.

2.04 Campus Serving Conduits

A. The conduit, manholes and pull box sizing and construction shall be coordinated with the FBISD Design Manager on a project-by-project basis.

B. Provide a minimum of (2) 2-inch conduits from MDF to future portable building locations. Additional conduits shall be added as required if fill capacity exceeds 40 percent.

C. Provide a minimum of (2) 4-inch conduits from the MDF to the IDF on the first floor of each additional building on the campus. Additional conduits shall be added as required if fill capacity exceeds 40 percent.

1. (1) 4-inch conduit shall be provided with 3-cell detectable MaxCell innerduct intended for 4-inch conduits.

2. Each innerduct shall have a different color identifier.

D. Where only the first building of a campus is being designed, (2) 4-inch conduits for each additional future building shall route from the MDF to an adequately-sized manhole or pull box at least 30 feet from the building edge.

E. Provide a minimum of (2) 2-inch conduit from MDF to digital marquee signage locations. Additional conduits shall be added as required if fill capacity exceeds 40 percent.

2.05 Innerduct

A. All OSP conduits shall have either Maxcell duct or HDPE innerduct installed prior to cabling installation. Conduits (4”) shall receive:

1. One 4” 3-cell Maxcell detectable fabric innerduct; or,

2. Refer to project drawings for more details on OSP conduit and innerduct requirements.

2.06 Duct Plug Systems

A. Reusable Inflatable Duct Plugs

1. Commscope TDUX

2. Maxcell Wolf Termination Bags

3. TE Connectivity Raychem Rayflate

4. Or approved equal

B. Mechanical Duct Plugs

1. Metraflex MetraSeal

2. Or approved equal

2.07 Duct Seal Putty

A. The Contractor shall seal all OSP conduits/ducts at all ends to make a water tight seal.

B. The Contractor shall also seal all gaps around the conduits/ducts including wall sleeves.

C. Should not adversely affect other plastic materials or corrode metal.

D. Should contain UV Stabilizers

E. Shall be designed for the specific application.

F. Manufacturer:

1. Rainbow Technology Duct Seal Putty 79511/79526

2. Or approved equivalent

2.08 Handholes

A. Conduits shall be interrupted by an adequately sized manhole or pull box at least every 600 feet for sections containing up to (1) 90-degree of bend and at least every 350 feet for sections with the equivalent of (2) 90-degree bends.

1. Manholes and pull boxes shall be of adequate depth for conduits to enter from the side of the pull box and not be required to sweep up into the bottom of box.

B. Pull boxes shall be a minimum of 36 inches long X 36 inches wide X 48 inches high.

C. All accessories such as racking, grounding and bonding, ladders and ancillary equipment shall be provided.

D. Underground enclosures shall be constructed of a polymer concrete material and have the same strength rating as concrete handholes of the same proportions.

E. Underground enclosures shall be rated for use at sidewalk, driveway, and parking lot areas.

F. Underground enclosures shall:

1. Be flush-mounted to the existing grade and constructed with a load rating of Tier-15.

2. Be equipped with a locking keyed mechanism.

3. Be equipped with cable racks, conduit entrances, and strut inserts.

4. Be designed for a long life over a wide range of temperature extremes.
5. Feature interlock for concrete sidewalk retention.
6. Be labeled “Telecom ##” where ## designates a numbering scheme to be approved by Owner.
7. Provide with lift hook.

G. 24” x 36” x48” underground enclosures shall be Hubbell PD2436BA48 with PG2436HA00 cover or other equivalent products, which meet these specifications.

H. 30” x 48” x 48” underground enclosures shall be Hubbell PG3048BA36 with PG3048HS00 cover or other equivalent products, which meet these specifications.

2.09 Underground Manhole Enclosures

A. Manholes shall have a minimum size of 5 feet long x 7 feet wide X 7 feet high with pulling eyes on either side and cable racking no more than 4 feet apart and a sump.

B. Underground enclosures with exterior dimensions of 6’-11”W x 12’-11”L x 8’D shall be constructed of pre-cast 6” thick concrete.

C. Underground enclosures shall be rated for use at sidewalk, driveway, and parking lot areas.

D. Underground enclosures shall:

1. Be equipped with cable racks, conduit entrances and strut inserts.
2. Have a neck in the center of manhole.
3. Have a long enough neck (34” minimum height) to that manhole cover is flush with finished grade or pavement
4. Have a cover that:
    a. Weighs a minimum of 200 pounds but no more than 250 pounds.
    b. Can withstand vehicular traffic (Rating of H-20).
    c. All covers shall be stenciled with “FBISD COMMUNICATIONS”.
    d. Is Factory cast with the label “COMMUNICATIONS #” where # designates a specific numbering scheme to be determined by Owner. Field labeling with a welder is not acceptable.
    e. Have installed a single 8 foot minimum electrode consisting of a ground rod made of solid copper or copper clad steel with a resistance to ground of less than 25 ohms.
    f. Be designed for a long life over a wide range of temperature extremes.
    g. Feature interlock for concrete or asphalt sidewalk retention.
    h. Contain a center drain with sump capable of completely draining manhole.

i. Have a 7/8” diameter galvanized pull iron.

5. Be equipped with a ladder that:

   a. Is permanently attached to the inside of the manhole.

   b. Is equipped with a retractable safety grab post that can extend up to three feet from the top of the manhole.

   c. Is constructed of aluminum.

Part 3 - Execution

3.01 Inspection

A. Examine areas and conditions under which the new exterior telecommunication pathways are to be installed.

B. Verify field measurement and pathway routing conditions.

C. Beginning of exterior telecommunication pathway installation indicates Contractor acceptance of existing conditions.

3.02 Directional Boring Operations

A. All directional boring operations are subject to the following conditions:

1. The machine operator shall follow all current OSHA regulations, including the use of grounding mats and other safety measures.

2. The machine operator shall have control over the direction of the boring tool.

3. The bore crew must have, in their possession, a copy of the permit authorizing the company to perform work, and a copy of the approved drawing and specifications for the bore work location.

4. When possible, the Contractor shall mark the proposed running line and bore head location. Mark the proposed running line every 5’ to 10’, using a longitudinal line; mark the actual location with a white paint spot at the end of each stem push. Only white paint is approved for this use.

5. The bore is not allowed to deviate more than six (6) inches from the proposed marked running line, and the ends of the bore must be at the designated depth.

6. Slurry use shall be kept at a minimum and only used for head lubrication and/or spoils return. The Contractor shall calculate anticipated slurry use and monitor slurry use during the bore operation to determine slurry loss into the surrounding soil.

7. Slurry must be contained during the bore operation and must be removed prior to backfilling, with dry dirt.

8. During pull back, the mandrels shall be not more than two inches larger than the diameter of the duct or casing.

9. Shallow bores or other unsuccessful bores shall be abandoned and filled.

10. The bore operation shall be stopped if any damage occurs to a road surface and it shall remain inactive until corrective measures are taken. The Contractor is liable for any damage done to the right-of-way or structures.

11. Auger heads are not allowed more than six inches ahead of the casing being inserted.

12. Bore stems and cutting heads may have to be left in the ground if they cannot be retrieved through the bore hole. Open excavation to retrieve the parts is not allowed.

13. When boring near creeks and streams, silt fences shall be properly installed to prevent disturbed soil from flowing into the waterways and remain in place after the bore has been completed.

14. Bores shall not be located beneath trees without specific permission in writing from the design team.

3.03 Excavation and Trenching Requirements

A. Make trench sides as nearly vertical (max depth is 48") as practical except where sloping of sides is allowed.

B. Remove all rock, boulders, hard material, unstable material, and yielding and unsatisfactory materials within the limits indicated for trench excavation and dispose of off the site. Notify the Owner's Representative immediately in writing if it becomes necessary to remove such materials beyond the trench limits. Where excavations are deeper or wider than the trench limits in order to remove unsuitable materials, they shall be refilled with approved borrowed material.

C. Existing concrete or granite curb encountered in excavation shall be temporarily supported or replaced in kind. Bituminous lip curb shall be disposed and replaced in kind.

D. Excavation operations adjacent to and below existing structures and utilities shall be done manually. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Owner's Representative. Report damage to utility lines or subsurface construction immediately to the Consultant.

E. Use appropriate traffic control as specified in the associated permits that the Contractor is to obtain.

F. Keep excavated materials and construction equipment and materials a safe distance back from the edge of excavations to avoid overloading the sides of the trench and to prevent slides or cave-ins.

G. Grade areas around trench as necessary to prevent surface water from flowing into excavations.

H. Walkway and grassed areas left backfilled at the end of the workday shall be enclosed with snow fence until restored to grade. Roadway trenches shall not be re-opened to traffic unless either a road plate capable of sustaining HS-20 loading is in place or temporary gravel is placed to bring the trench area to finish grade.

I. Keep excavated materials out of the gutter lies and other surface water runoff paths.

J. Sweep tracked sediment or soils off streets daily.

3.04 Cutting Pavement

A. Where trench excavation occurs in paved areas, saw cut existing pavement to obtain sound, vertical edges one foot wider than the indicated trench width on each side of the trench. When the saw cut is within two feet of an existing joint or curb, remove pavement to the existing joint or curb or as required by the Owner, etc.

B. Existing pavements and base course beyond the indicated lines for trench excavation which have been disturbed, damaged or undermined shall be restored or replaced by the Contractor to match existing pavements and base course or as requested by the Owner, etc.

3.05 Back Filling

A. Construct backfill in two operations (initial and final) as indicated and specified in this section. Initial backfill shall be select backfill material placed in 6-inch maximum loose lifts to one foot above conduit or duct unless otherwise specified. Bring up evenly on each side and along the full length of the conduit or duct structure. Ensure that no damage is done to the conduit or duct structure, or its protective coating or as required by the Owner, etc.

B. Place the remainder of the backfill (final backfill) in 6-inch maximum loose lifts to the bottom of the sub-grade, unless otherwise specified. Compact each loose lift before placing the next lift. Do not backfill where the material in the trench is muddy, except as authorized or as required by the Owner, etc.

C. Provide a minimum cover from final grade of 42 inches for fiber ducts unless otherwise indicated on the Drawings or as required by the Owner, etc.

D. Where settlement occurs in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation or as required by the Owner, etc.

E. The Contractor shall coordinate back filling with testing of utilities. Testing for the following shall be complete before final back filling: water distribution, sanitary sewer, steam compressed air, fuel oil, and refrigeration systems.

3.06 Compaction

A. Use hand-operated, plate-type, vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with local code unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet compaction requirement and meet requirements of the Owner, etc.

3.07 Protection of Existing Utilities, Structures and New Work

A. Excavation, backfill and compaction operations shall be done in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work. Backfill shall be placed and compacted to prevent future settlement or damage to existing utilities and structures and new work and meet requirements of the Owner, etc.

B. Any damage due to excavation, back filling or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Owner's Representative, shall be borne by the Contractor at no additional expense to the Owner and meet requirements of the Owner, etc.

C. Protect newly back filled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and re-establish damaged or eroded grades and slopes and restore surface construction prior to acceptance. Protect existing storm drain inlets from water-borne soil and meet requirements of the Owner, etc.

3.08 Restoration

A. The Contractor is responsible for repairs to any streets, sidewalks, grass areas, etc., which must be trenched or otherwise disturbed in the process of installation. In areas owned by the Owner, the cities have final determination whether such repairs are acceptable.

A. In areas owned by Owner, the Owner has final determination whether such repairs are acceptable.

B. All sidewalks, streets, alleyways and landscaping shall be replaced to its original condition or better.

C. All existing conditions shall be videotaped prior to construction activities to provide information of pre-existing conditions.

D. Grassed Areas:

1. After completion and acceptance of all conduit, excavation, and backfilling work in a given area, the Contractor shall seed to cover all disturbed areas. The Contractor may choose to cut and remove turf prior to the area being disturbed. This would be used to place back over the disturbed area and meet

requirements of the Owner, etc. The Contractor shall water all restored grass areas for a duration of 30 days as a minimum and return in the spring the following year as required to patch areas.

E. Sidewalks:

1. All sidewalks shall be constructed using the same backfill and compaction procedures used for street opening.

2. Unless unusual conditions exist, sidewalk panels, which are cut into for construction, shall be replaced with full panels. New or prior construction saw cuts are not considered as panel ends. Sidewalk panels end at score lines, curbs, boulevards or property lines. If curb is part of the sidewalk panel, the curb shall also be replaced.

3. The Contractor shall take care in removing sidewalk panels. If adjacent panels are chipped, the Contractor will be required to replace them.

4. Any pedestrian ramp removed shall be replaced to the current Cities, County and ADA standards. Please note that this may involve removal and replacement of additional curb and gutter and/or sidewalk panels that were disturbed by the fiber optic installment. The Contractor shall ensure compliance with current regulations. Newly installed pedestrian ramps that do not meet current ADA standards will need to be removed and replaced at the Contractor's expense.

F. Road Restoration:

1. The Contractor shall properly replace or cause to be replaced all pavement cut into and disturbed by the Contractor in compliance with local Municipal Codes, and in the manner and following the specifications required by the Cities and County Engineers.

2. The Contractor shall comply with the Cities and County Codes and standards.

3. In the event of the Contractor's failure to do so, the Cities or County may replace such pavement or employ another contractor to do so, at the expense of the Contractor, such expense to be deducted from the final payment.

4. In addition, the Cities and County may take such civil action as provided by law, including, but not limited to, imposition of penalties or other relief as provided for herein.

3.09 Work Within Buildings

A. If cable taken into a building is not in a metal conduit, it shall be terminated within fifty feet (50') of the point of entry into the structure. If the termination point (telecommunications room) is located further than 50' from the point of entry into the structure, rigid metallic conduit shall be installed from the building penetration point all the way to a telecommunication room.

B. Any cable that shall be properly sealed and tested at building entrance.

C. At each building entrance, a maintenance loop of fiber 4 feet in diameter and 10 to 15 feet in length must be installed.

3.10 Cutting and Patching

A. Where it is necessary to do any cutting and patching, no cutting of beading walls, beams, etc. shall be done without the approval of the Owner's Representative. All patching, finishing, etc. shall match the surroundings. All cutting and patching shall be done by workmen skilled in the trades.

B. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted as required by limited working space.

C. Holes shall be located so as not to affect structural sections such as beams.

D. Holes shall be laid out in advance. The Owner's Representative shall be advised, prior to drilling through structural sections, for determination of proper layout.

E. Floor, exterior wall, and roof seals shall be watertight. Walls and floors that are cored for installation of conduit shall be sleeved with steel tubing, grouted, and the space between the conduit and sleeve filled as specified herein.

F. Conduits shall extend four-inch minimum above finished floor.

3.11 Grounding and Bonding

A. Use a sheath grounding unit to ground the outer shield and armor of the fiber-optic cables at the buildings entrances to a building existing ground infrastructure.

A. All metallic cable elements at splice points and building entrance must be bonded and grounded to the building metal structure.

B. Copper wire AWG #6 should be used as a minimum.

C. Clean each grounding component with 300-grit emery cloth before bonding and apply a mineral-oil-based oxide inhibitor to the bond area.

D. Install sheath grounding units for all fiber-optic cable ground locations in splice handholes/manholes. In the fiber-optic splice handhole/manhole, only one sheath grounding unit is needed between the splice enclosure and the ground rod. Sheath-grounding unit shall be used on each fiber-optic cable entering/exiting the splice enclosure. Each fiber optic cable sheath shall be connected to a test station. The sheath grounding unit shall:

1. Connect to the cable armor.

2. Be designed for below grade use and have a No. 6 AWG stranded copper lead wires.

E. The Contractor shall apply an oxide inhibitor over bonded connections to ground rods. The oxide inhibitor shall provide an airtight seal around the conductor and ground rod.

F. The Contractor shall bond the ground conductor to the ground rod by one of three methods: compression bond, exothermic welding, or irreversible compression bond.

G. The Contractor shall achieve an irreversible compression bond by:

1. Using a hydraulic press with a connector die.

2. Using a solid copper connector with a run for a 0.625-inch ground rod and a tap for the specified ground conductor.

3. Using connectors that can accommodate a conductor range from No. 6 solid copper through 500 Kcmil.

4. Using connectors that are pre-filled with an antioxidant compound and are strip sealed.

H. All metallic cable elements at splice points and building entrance must be bonded and grounded to the building metal structure.

I. Copper wire AWG #6 should be used as a minimum.

3.12 Support and Anchors

A. The Contractor shall exercise judgment when supporting equipment. If support methods are questionable or not available, the Contractor shall call it to the attention of the Engineer prior to installation.

B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, spring steel clips.

C. Install hangers and supports, sleeves and fasteners in accordance with approved printed manufacturers' installation procedures, and as specified.

D. Coordinate all affected trades and all aspects of the electrical work, including installation of raceways and wiring as necessary to interface installation of supporting devices with other work.

E. Install hangers and supports, and attachments to properly support raceways, equipment and accessories from building structure.

3.13 Duct Installation

A. The duct shall be joined at the "tie-in" locations using metal couplers designed to thread the two ends of PVC conduits together. These couplers shall provide a pull-proof connection of the duct.

B. The depth at which buried duct shall be placed will vary with local conditions. PVC duct should be buried a minimum depth of:

	Location	Depth
1.	Location	Depth
2.	Minimum cover in soil	42 in.
3.	Minimum cover under draining ditches	42 in.
4.	Minimum cover under railroads	140 in. below top of rail
5.	Minimum cover at roadway crossing	60 in.
6.	Minimum cover in rock	36 in.

C. When crossing unimproved roads, streets and alleys that may later be paved or hard surfaced, the cable should be placed at a depth that retains sufficient cover following permanent grading of the road. The Contractor shall coordinate with Owner the depth of each street crossing.

D. When crossing rail road tracks, PVC conduits shall be placed into 6” steel casing.

E. During construction, the end of the ducts shall be plugged to prevent water washing mud into the duct.

F. The Contractor shall seal watertight ends of all ducts at each handhole/manhole.

G. The Contractor shall seal openings around ducts that pass through handhole/manhole walls with a silicone sealer for a waterproof seal.

H. The Contractor shall proof all conduit sections prior to installation of the fiber cable to ensure conduit integrity. After proofing of the duct, measurements will be taken to verify the length of the installed conduit.

I. The Contractor shall leave a pull tape in the conduit with the cable after installation.

J. The Contractor shall leave a pull rope in all empty conduits after installation.

K. Install a trace wire in all empty conduits consisting of one #12 steel or copper wire.

3.14 Innerduct Installation

A. Contractor shall install according to manufacturer’s installation recommendations.

1. Contractor shall use a ball-bearing swivel to prevent twisting of fabric innerduct.

2. Fabric innerduct for future use shall be neatly folded and secured to a nearby wall.

3.15 Buried Warning Tape

A. When trenching is involved or required by certain conditions (i.e., customer or citizen request, topographical reasons or as directed by the State or City forces), the use of warning tape is required. A bright orange (preferably "ULCC" orange) warning tape with a minimum width of three inches shall be buried approximately one foot below the existing grade. As a minimum, the tape should be marked "WARNING-

OPTICAL CABLE." The tape shall be placed directly above the conduit to alert any excavator of the presence of an underground facility.

3.16 Inspection and Cleaning of Existing Conduits

A. The following provisions shall apply to Existing Conduit Systems:

1. When installing fiber optic cable in existing conduits through existing manholes, the Contractor shall visually check the cable route to ensure that there is a smooth transition between exit and entrance elevations and that the horizontal and vertical angle is not so sharp as to cause damage to the cable as it is being pulled through the existing conduit. Should the Contractor encounter sharp bends in existing conduit, the Contractor shall bring the situation to the Consultants's attention. Reinstalling existing conduit through a hand hole to provide smooth transitions is a potential solution.

B. Clean the existing conduit of any debris that could impede pulling fiber optic cable through it or that could damage the cable if the debris remained.

C. Inspection and Cleaning Existing Conduit Systems includes but shall not be limited to inspecting the cable route, notifying the Engineer of sharp bends, cleaning, and all materials and labor necessary to Inspect and Clean Existing Conduit Systems. Inspection and cleaning of existing conduit systems shall be considered incidental for which no direct compensation will be made.

3.17 Test and Acceptance Criteria

A. Testing

1. The Contractor will be provided with cable manufacturer's test report for each reel of cable provided. These test reports will include (1) manufacturer's on-reel OTDR and attenuation test results for each optical fiber of each reel prior to shipment from the manufacture and (2) on-the-reel bandwidth performance as tested at the factory.

2. The Contractor will perform on-reel OTDR tests for each fiber strands of each provided reel prior to taking the reels from the yard. The OTDR test shall be in one direction at 1550 nm.

3. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests.

4. Upon completion of the fiber optic cable installation, the Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Consultant may be in attendance to witness the test procedures. The Contractor shall offer adequate advance notice to the Consultant as to allow for such participation.

5. The Contractor shall utilize a manufacturer-recommended "OTDR Trace Analysis" and a "Power Meter Report" software program or a single software program that is a combination of "ODTR Trace Analysis" and "Power Meter Report.". The Contractor shall identify the software to the Owner as part of the

Project Documentation Submittal. If the Owner does not already own a copy of the proposed software, the Contractor shall provide the Owner with a licensed copy.

B. Tests After Installation

1. Upon completion of cable installation and termination, the Fiber Optic cabling shall be tested to include:
2. Optical Attenuation (“Insertion Loss” Method)
3. Verification of Link Integrity (OTDR)
4. Optical return loss (ORL)

C. Optical Attenuation Testing

1. Optical Attenuation shall be measured on all terminated optical fibers in both directions of transmission using the “Insertion Loss” method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made.
2. Multi-mode fibers shall be tested in accordance with the TIA/EIA 526 14A, Method B at 850□30 nm and 1310□ nm. Single mode fibers shall be tested in accordance with the TIA/EIA 526-7-1998. Method A.1. Testing shall be at 1300□20 nm and 1500□10 nm.
3. Attenuation of optical fibers shall not exceed the values calculated as follows:
4. Attenuation (max.) = 2*C+L*F+S dB
5. Where C is the maximum allowable Mated Connector Loss 0.35 dB, L is the length of the run (in kilometers) and F is the maximum allowable fiber loss (in dB/km). S is the total splice loss □0.1 dB (# of splices * max. attenuation per splice).
6. Documentation of the insertion loss testing for each fiber run shall be provided to the Owner to include a record of:
7. Wavelength
8. Fiber type
9. Fiber and cable number
10. Measurement direction
11. Test equipment model and serial number
12. Operator
13. Test documentation must be stored in a floppy disk and printed as a hard copy with all test results labeled.
14. All testing is to be done through connectors.

15. Any fiber that fails testing must have appropriate corrective action taken to rectify the situation.

D. Optical Time Domain Reflectometer (OTDR) Testing

1. The OTDR shall comply with the latest revision for the Bellcore/Telcordia Document GR-196-CORE “Generic Requirements for OTDR-Type Equipment” and SR-4731 “OTDR Data Format.” In addition, the OTDR performance requirements shall comply with the following:
2. The event dead zone shall be less than or equal to three meters.
3. The attenuation dead zone is less than or equal to 5 meters.
4. Has a dynamic range of 25 dB or greater.
5. Each fiber shall be tested after splices are sealed in the Outdoor Fiber Splice Enclosure. Should any fiber fail ODTR or power meter test, re-splice that fiber and retest all fibers disturbed in the splice enclosure.
6. All links shall be tested bi-directionally with an OTDR that are 330 feet (100 m) or longer. (Contractor shall supply the OTDR meter – see below.) Single mode fibers shall be tested at 1310/1550-nm (nominal).
7. The Contractor shall provide a flowchart for each tested fiber cable. The flowchart shall illustrate location of launch and end of a fiber link, interconnect points, and splice points. The flowchart shall be used to distinguish a splice from a micro/macrobend.
8. Launch cables of adequate length (1000’ minimum) shall be used to allow viewing of the entire length of the cable, including the connectors at the launch and receive end.
9. OTDRs used as part of these testing specifications shall be calibrated to sheath (jacket) length, not optical length by adjusting the unit's index of refraction.
10. All OTDR traces shall maximize both the vertical and horizontal scales to the greatest extent possible and still fit the entire cable link trace on the screen with optimum resolution.
11. All OTDR tests shall be averaged for a minimum of two (2) minutes.
12. Failure of a link at any part of the testing shall result in the contractor having to repair the problem and retest the installation. Cost for any required repairs and re testing shall be borne solely by the Contractor.
13. Reflective and non-reflective events shall be marked by OTDR, and the data for each event must be retrievable.
14. In an event where two non-reflected event anomalies (“gainer” and “exaggerated loss”) are detected by OTDR in any given splice point, the bidirectional average of each splice must be calculated by the Contractor to get the actual value for each splice.

15. OTDR traces revealing a point discontinuity greater 0.1-dB (average, when tested by-directionally) in a single mode fiber at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that fiber by the Owner.
16. Where applicable, test each fusion splice in the forward and backward directions. Each reading (not an average) shall be recorded. All events shall be recorded.
17. OTDR traces revealing a “Ghost” shall also be a valid basis for rejection of that fiber by the Owner.
18. The installation of that cable shall be reviewed in an effort to solve any problems that may be causing the fault. If such efforts do not remove the fault, that cable and the associated terminations shall be replaced at the expense of the Contractor.
19. All fiber shall be tested for attenuation loss using an OTDR set to 2 Point loss measurement parameters. Marker points shall be placed at the beginning and end of each backscatter signature recorded by the OTDR. The manufacturer’s instructional guide can be used to determine proper placement of these markers.
20. Links that contain splice points or interconnect points shall also contain an additional "Events Display Table" to accompany the OTDR trace. This display shall show the distance to the events, distance between multiple events, each events loss in dB, and a description of the event (reflective event, non-reflective event, gains and cable end). All attenuation event loss readings shall be in the LSA (Least Square Average) mode of the OTDR. 2-Point attenuation measurements at events are not acceptable.
21. Proper pulse width selection is required to minimize attenuation dead zone effect.
22. Fiber links that are shorter than 6000 feet require pulse width to set to 10ns. That is equal to MM dead zone=23 feet (7 m), SM dead zone = 33 feet (10 m).
23. The OTDR display shall be recorded on USB Flash Media with identification and numbering, sequences to be pre-approved by the Engineer. Each trace must contain as a minimum:
24. Cable/sheath length (not optical fiber length)
25. 2-point dB loss, attenuation in dB/mile (dB/km)
26. Fiber type
27. Wavelength used
28. Pulse width selection
29. And fiber/cable identification

30. The stored fiber trace shall allow full manipulation of the trace when viewed with the PC emulation software. Both a hard copy printout and soft copy of each trace shall be submitted to the consultant for approval.

31. The Contractor shall provide the Owner with a licensed copy of OTDR trace viewing software one week prior to OTDR tests starts.

32. Documentation of the OTDR signature traces displaying the entire length of the cable run shall be provided to the Owner to include a record of:

33. Wavelength

34. Fiber type

35. Fiber and cable number

36. Measurement direction

37. Test equipment model and serial number

38. Operator

E. ORL Testing

1. All connectors at single mode fiber links shall be tested for optical return loss (ORL) using OTDR. The OTDR shall be capable to measure connector spike with respect to the backscatter signal on the OTDR. This technique shall be accomplished by software embedded in the instrument.

2. The launch cords must be kept clean and periodically repolished to ensure as perfect a surface finish as possible to match polishing on the connectors.

3. The single-mode connector's optical return loss shall be not less than 60 dB for APC connectors.

4. Test documentation must be stored on a USB Flash Media and printed as a hard copy with all test results labeled.

5. The Contractor shall provide the Owner with a licensed copy of OTDR trace viewing software one week prior to fiber test starts.

3.18 Documentation

A. As-built drawings

1. The following requirements apply to all record drawings:

2. Location coordinates for each splice point, handhole/manhole and underground cable shall be indicated on the record drawings.

3. The record drawings shall be maintained at the Contractor's expense.

4. All such drawings shall be provided as necessary for clarification.

5. The record drawings shall be in 1"-30' scale.

6. The Contractor shall indicate on the drawings the fiber optic cable location with the reference to the center of the street.
7. The record drawings shall be returned to Consultant on completion of the work and are subject to the approval of the consultant.
8. The record drawings shall be submitted in the following formats:
9. In one blueline set
10. In one reproducible set
11. In one AutoCAD set
12. As-built drawings shall be submitted to the Engineer within 40 working days subsequent to the substantial completion. The Engineer reserves the right to allow the Contractor greater than 40 working days after contract approval to make submittals.

B. Test Records

1. Test readings shall be recorded along with the annotation that these are post installation readings. Printed copies of these readings shall be provided to the Owner upon completion of the project. Records are to include date of testing, name of technician, and readings of all above-described test results.
2. The objective of fiber optic cable test documentation is to document OTDR and Power Meter test results to verify that these results meet specifications, as well as to document the link loss, fiber optic cable distance between splices and terminations, and the fusion splice losses.
3. The following provisions shall apply to fiber optic test documentation:
4. The Contractor shall provide post installation documentation on USB Flash Media.
5. The Contractor shall record power meter and OTDR test data, fiber count, and fiber routing of the cable and cable run.
6. Measure and record the following values for all fiber optic cables:
7. Fiber optic cable length markings at all splice and termination locations on the fiber optic schematics.
8. Fiber optic cable index of refraction.
9. Attenuation of each fiber optic splice in both directions and average attenuation.
10. Event notes for each trace. These notes shall identify each splice location and shall be consistent with each fiber optic schematic vault location.
11. Attenuation of each fiber optic link, in both directions, as measured with a light source and power meter at 1550 nm wavelength for SM.

12. Manufacturer's reel (spool) test documentation that is shipped with the fiber optic cable spool.

3.19 GPS Component and Utility Location Data

A. Collect location coordinates for each splice point, handhole and underground cable, including cable installed in conduits and empty conduits using a GPS receiver capable of sub foot accuracy.

A. Location data must meet the following criteria:

1. The collected coordinates should be accurate to less than one foot.

2. Use a minimum of five (5) satellites by the receiver to collect location data.

3. Data to be collected based on NAD83 (1996) HARN adjustment with G03WGS84 or NAD83 (2007) adjustment with G09WGS84.

4. The coordinate system shall be the State Plane Texas South Central FIPS 4204 Feet coordinate system.

5. For the projects located not in the State Plane Texas South, a designer shall change the paragraph 3.24.B.4 to "The coordinate system shall be the Pre-Defined County Coordinate System."

B. Measure above-ground components from the street side of the asset collected.

C. Collect underground cable location no more than two (2) weeks after it has been installed. Collect underground cable as line geometry. Capture the vertex points every 100 feet and at every junction or change in cable direction. Depth does not need to be collected unless underground cable is installed outside the depth of 42 inches.

D. If depth change has occurred, capture a vertex point before and after the depth change.

E. If GPS coordinates are required for in-place underground facilities, capturing the coordinates based on recent aboveground utility locate markings would be acceptable.

F. Data that does not meet the above criteria and guidelines may be rejected, and the contractor would be responsible to repeat the data collection.

End of Section

Section 27 15 00 – Communications Horizontal Cabling

Part 1 - General

1.01 Scope

A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.

B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as "station cabling".

C. The horizontal cabling system will consist of the following:

1. Unshielded Twisted Pair (UTP) Cable
2. Outlet Termination Modules (jacks)
3. Outlet Termination Plates
4. Horizontal Fiber Optic/Copper Composite Cabling
5. Above Ceiling Cable Support Systems
6. Horizontal Cable Testing Requirements
7. Cable Pathway/Sleeve Requirements

D. Full system functionality must be maintained during additions and renovations in unaffected areas.

E. Remove and disconnect abandoned cabling in walls and above ceilings. patch wall, ceiling, and floor penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 05 00 for additional requirements.

B. The contractor shall have a minimum of 5-years' experience.

C. The contractor shall have a minimum of (2) certified BICSI Installers in good standing and a full-time employee of the company and on-site at all times.

D. The Contractor project manager shall be an RCDD (Registered Communication Distribution Designer) in good standing and a fulltime employee of the company and be present at all on site coordination meetings.

E. All structured cabling systems shall be installed by an authorized and registered Panduit Gold Certified Installer in good standing.

F. RCDD and BICSI Certified Technicians will be present at the following meetings:

1. Low Voltage Preinstallation Meeting
2. Cabling System Pathway Mockup
3. Owner walks / System inspections
4. Coordination Meetings
5. And Other events as requested by the Owner

G. Certifications

1. Documented proof that the contractors project manager is an RCDD shall accompany the proposal response.

2. Certificates of attendance will be submitted for attendance in manufacturer's installation/ maintenance training by the Contractor's directly employed personnel. All structured cabling systems shall be installed by an authorized and registered Panduit Gold Certified Installer in good standing.

3. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturers for installation of all proposed components. Company Certifications shall accompany the proposal response.

4. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.

5. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.06 Pre-Construction Submittals

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. As-Built Documentation

1. Provide drawings depicting the condition of the Structured Cabling System as installed produced in AutoCAD 2013 or higher and provided in hardcopy, electronically in .DWG and .PDF format. Drawings shall be sealed by a current BICSI certified RCDD and shall include but not be limited to the following:

a. Region lines identifying exactly which data drops are served from which MDF / IDF

b. Exact locations of MDF and IDF Rooms.

c. MDF and IDF Room layouts with exact dimensions.

d. MDF and IDF Room wall elevations.

e. MDF and IDF Room equipment rack elevations.

f. Cable pathways, including cable runways, cable tray, sleeves, backbone and horizontal cable pathways.

g. Data drop locations for all data drops (data, voice, wireless, security, etc.)

h. Correct room numbers identified.

i. Correct labeling scheme with all data drops labeled.

2. A laminated half-size hard copy of the as-built drawings for the applicable region served by the MDF and/or IDFs shall be provided in MDF and each IDF for reference.

3. At the time of network installation install, complete Communication As-Built Documentation to be provide to FBISD.

B. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 General

A. Wall phone workstations shall be equipped with a studded wall phone faceplate capable of accepting a modular jack insert.

B. All faceplate colors shall be coordinated with FBISD Design Manager and the Architect during the design.

C. When a data outlet is installed above the accessible ceiling (i.e., IP camera, WAP, etc.) the modular jack shall be inserted in surface mounted box and secured to the building structure. No higher than 3 feet above ceiling grid preferred is 1 foot.

2.03 Category 6 Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. Horizontal Data Cabling shall be Category 6 plenum rated UTP installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link

D. This specification defines the requirements for commercially available high performance Category 6 cable.

E. This cable shall be utilized and suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

F. The cable design described herein shall exceed transmission performance of Category 6 cables.

G. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

H. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

I. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

J. Manufacturers:

1. Panduit
2. Berk-Tek Lanmark 1000
3. General Cable Genspeed 6000
4. Commscope Uniprise Ultramedia 6
5. Belden
6. Or FBISD approved equal

K. Acceptable manufacturers for horizontal cabling shall be a manufacturer certified and authorized to offer the required Panduit 25-year warranty or FBISD IT approved equal.

2.04 Category 6a Horizontal Copper Cables (WAPs only)

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. Horizontal Data Cabling shall be Category 6A plenum rated UTP installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link.

D. All wireless access points shall utilize Category 6a cable. GYM to have a minimum of (4) WAPs.

E. This cable shall be utilized and suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

F. The cable design described herein shall exceed transmission performance of Category 6a cables.

G. Category 6a cables shall be bundled separately from lower Category rated cabling.

H. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

I. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

J. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

K. Manufacturers:

1. Panduit
2. Berk-Tek LM-RDT
3. General Cable GenSPEED 10 MTP Gen 5 or later
4. Commscope Uniprise CS44P SD
5. Belden
6. Or FBISD approved equal

L. Acceptable manufacturers for horizontal cabling shall be a manufacturer certified and authorized to offer the required Panduit 25-year warranty or FBISD IT approved equal.

2.05 Category 6a Inside/Outside Plant (OSP) Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. Horizontal Data Cabling shall be Category 6A plenum rated UTP installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link.

D. This cable shall be gel free.

E. The cable shall be CMX/CMP rated.

F. The cable shall be utilized and suitable for installation in exterior conduit/pathway, below slap conduit/pathway such as ground level floor boxes, free-air, in building risers, in interior conduit, and/or in cable tray and shall carry OSP indoor/outdoor with CMP rating. This cable shall not be utilized for direct bury applications.

G. The cable design described herein shall exceed transmission performance of Category 6a cables.

H. Category 6a cables shall be bundled separately from lower Category rated cabling.

I. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

J. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

K. OSP cabling shall not terminate directly on patch panel on rack. A wall mounted transition point will be utilized to transition to plenum rated cable.

L. For cabling entering the building from an exterior location, furnish and install with PoE compatible building entrance surge protector on building side as close to the point of entry as practical. This surge protector may act as a transition point to CMP rated cable. Bond surge protector to building steel or nearest ground point.

M. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

N. Manufacturers:

1. Panduit
2. Berk-Tek LM-RDT I/O Cat 6a
3. General Cable GenSPEED 10 MTP Indoor/Outdoor
4. Commscope Uniprise CS34P-IO
5. Belden
6. Or FBISD approved equal

O. Acceptable manufacturers for horizontal cabling shall be a manufacturer certified and authorized to offer the required Panduit 25-year warranty or FBISD IT approved equal.

2.06 Category 6a Outside Plant (OSP) Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. Horizontal Data Cabling shall be Category 6A plenum rated UTP installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link.

D. This cable shall be gel filled, UTP.

E. The cable shall be utilized and suitable for installation in exterior conduit/pathway, below slap conduit/pathway such as ground level floor boxes, free-air, in building risers, in interior conduit, and/or in cable tray and shall carry OSP indoor/outdoor with CMP rating. This cable shall not be utilized for direct bury applications.

F. The cable design described herein shall exceed transmission performance of Category 6a cables.

G. Category 6a cables shall be bundled separately from lower Category rated cabling.

H. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

I. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

J. OSP cabling shall not terminate directly on patch panel on rack. A wall mounted transition point will be utilized to transition to plenum rated cable.

K. For cabling entering the building from an exterior location, furnish and install with PoE compatible building entrance surge protector on building side as close to the point of entry as practical. This surge protector may act as a transition point to CMP rated cable. Bond surge protector to building steel or nearest ground point.

L. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

M. Manufacturers:

1. Panduit
2. Berk-Tek Lanmark-10G
3. General Cable GenSPEED Category 6A Outside Plant Cable
4. Commscope Systimax 1592A
5. Belden
6. Or FBISD approved equal

2.07 Data Cabling Colors

A. The jacket color for data cables shall be:

1. Standard Data Outlets – BLUE

2. Wireless Access Points – GREEN

3. IP Security Devices (Cameras, Access Control Panels, Intrusion Detection Panels, Vape Detectors, etc.) – ORANGE

2.08 Category 6 Extended Distance Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. This specification defines the requirements for commercially available extended distance Category 6 cable.

D. When utilized for installation free-air, in building risers, in conduit, and/or in cable tray the cable shall carry a CMP rating.

E. When utilized for installation below the building slab in conduit within the building envelope, the cable shall have a CMX/CMP indoor/outdoor rating.

F. When utilized for installation in underground conduit outside of the building envelope the cable shall be gel filled OSP rated for wet environments.

G. The cable shall utilize 22 AWG conductors.

H. The manufacturer shall have custom testing perimeters for extended length cables compatible with the cable certifier utilized on the project. These results shall be submitted with the as-builts.

I. Distance shall be based on 1Gpbs performance at 90 watts of PoE.

J. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

K. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

L. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer and able to accommodate the larger conductors.

M. Manufacturers:

1. Panduit
2. Paige Datacom GameChanger
3. General Cable GenSPEED 6 MAX
4. Commscope Systimax GigaREACH XL
5. Belden
6. Or FBISD approved equal

2.09 Outside Plant (OSP) Cable and Penetration Sealant

A. The Contractor shall seal all OSP cable ends with an appropriate sealant.

B. Should not corrode copper and be appropriate for electronics.

C. Should have non-sag properties.

D. Utilize manufacturer recommended product to not void warranties.

E. Manufacturer:

1. Rainbow Technology B-Sealant 79500
2. Or manufacturer approved equivalent

2.10 Information Outlet

A. General

1. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.
2. SIOs shall be mounted in new outlet boxes, where existing boxes are in place, on surface mount raceway typically in surface raceway with barrier, in floor mount interface boxes, or on power poles either currently owned or new.
3. The telecommunications outlet frame shall accommodate or incorporate the following:
    a. A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.
    b. A mechanism for adjusting the surface plate to a plumb position.
4. When multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.

5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.

B. Modular Jack

1. Data jacks shall be non-keyed 8-pin modular jacks.
2. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
3. Jacks shall utilize a four-layer printed circuit board to control NEXT.
4. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
5. Modular jack contacts shall accept 2500 plug insertions.
6. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
7. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
8. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.
9. Jack termination shall be 110 IDC, integral to the jack housing, laid out in two arrays of four contacts.
10. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
11. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.
12. Jacks shall terminate 22-26 AWG stranded or solid conductors.
13. Jacks shall terminate insulated conductors with outside diameters up to .050".
14. Jacks shall be compatible with single conductor 110 impact termination tools.
15. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
16. Jacks shall be marked as either T568A or T568B wiring.
17. Category 6 jacks shall be manufactured by:
    a. Panduit Mini-com
    b. Or FBISD approved equal
18. Category 6a jacks shall be manufactured by:

a. Panduit Mini-Com

b. Or FBISD approved equal

C. Data Jack Colors

1. The color for data jacks shall be:

a. Standard Data Outlets – BLUE

b. Wireless Access Points – GREEN

c. IP Security Devices (Cameras, Access Control Panels, Intrusion Detection Panels, Vape Detectors, etc.) – ORANGE

D. Outlet Faceplates

1. Faceplates shall match the electrical outlets for material type and color and may vary by location.

2. Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.

5. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one RJ-45 jack, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting. Some types of phones may require a horizontal mounting.

6. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.

7. Faceplates shall be manufactured by modular jack manufacturer.

E. Surface Mount Interface Box

1. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.

2. The box shall feature built-in cable management for both fiber and copper applications.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

5. The box shall have the capability to incorporate optional magnets that can be internally mounted.

6. Surface mount box shall be manufactured by modular jack manufacturer.

2.11 Communications Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All patch cords shall be round and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The patch cords shall match the Category rating of the jack and cable it will be connecting to.

F. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors and quantities.

G. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

H. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels) for a complete system. Cords shall be highest quality patch cords available by connectivity manufacturer and match the performance grade of the utilized horizontal cable solution. Exceptions may be

acceptable in special circumstances such as OSP or shielded applications and should be included in the submittals for review.

I. Manufacturers:

1. Panduit
2. Or FBISD approved equal

J. Patch Cable Colors

1. The jacket color for patch cables shall be:
    a. Standard Data Outlets – BLUE
    b. Wireless Access Points – GREEN
    c. IP Security Devices (Cameras, Access Control Panels, Intrusion Detection Panels, Vape Detectors, etc.) – ORENGE

K. Locations and types of patch cords:

    a. The contractor shall provide one patch cord for every terminated jack at the patch panel. These cords shall be turned over to the Owner.
    b. The lengths of the cords shall depend on the rack layout to enable patching in the network switches.
    c. Coordinate required lengths with FBISD IT.

2. Installed network devices
    a. The Contractor shall provide one patch cord for every permanently installed IP device, such as a surveillance camera, intercom station, or wireless access point. These cords shall be turned over to whoever is installing the associated device, which may be a different subcontractor, an Owner's vendor, or the Owner's IT department.
    b. Outdoor-mounted devices shall receive a shielded patch cord.
    c. Patch cords for installed network devices shall be plenum rated.
    d. Coordinate required lengths with FBISD IT.

2.12 Fiber Optic Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All MM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Aqua jacket.
2. Have LC-LC connectors with straight thru connectors (A-A Polarity). Adjust as required for the specific device being connected.

3. Have 50-micron OM4 core.

C. Locations and types of fiber optic patch cords:

1. Installed network devices

a. The Contractor shall provide one patch cord for every contractor furnish and installed network device with SFP or fiber optic connections, such as a fiber optic media converter, remote network switches/power supplies such as those on a pole or exterior enclosure, servers such as a video surveillance server, etc. These cords shall be turned over to whoever is installing the associated device, which may be a different subcontractor, an Owner's vendor, or the Owner's IT department.

b. b. The lengths of the patch cords shall depend on the installation conditions. The Contractor shall review the specific installation conditions and use that to inform the patch cord lengths.

2. In the MDF and IDF Rooms furnish at the time of network installation (1) 10-foot 10GBE LC to LC fiber optic patch cable plus 25 percent spare for each terminated strand.

3. Patch cable length is determined as needed per MDF and IDF Room layout and shall be coordinated with FBISD Technology Department. Fiber optic patch panel / Network Switches

a. Patch cords at the rack shall be non-plenum.

2.13 Ethernet with Power over Ethernet (PoE) UTP Surge Suppressor for OSP Data Cabling

A. The Contractor shall furnish and install a surge protector for all outside plant cabling and exterior mounted cameras.

1. All exterior cameras shal receive a surge protector at the camera side and interior termination side.

B. When patched directly to a device, there shall be a minimum of a 36" shielded patch cable from the surge protector to the device to allow for adequate clamping time.

C. Bond to building steel or ground point with a minimum of a 14 AWG green solid copper cable keeping the distance as short as practical. Ground connection shall not exceed 5 ohms.

D. When protector is mounted in interior, dry or weather sealed enclosure:

1. Shielded RJ-45 jacks and ground stud

a. Connect ground directly to building ground as close to the point of entry as practical. When installed within a telecommunications room, ground directly to the ground bar.

b. Do not use shielded cable on the output.

2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)
3. Supports IEEE 802.3af (PoE)
4. Max current rating of 30A per pair.
5. UL 497B listed
6. 110 punch down in and 110 punch down out.
    a. 110 punch down in and RJ-45 out may be used when output is connected directly via patch cable to a device port only or when approved in specific situations.
7. Manufacturer:
    a. 110 to 110 - Ditek DTK-110C6APOE
    b. 110 to RJ-45 – Ditek DTK-110RJC6APOE
    c. Or approved equal

2.14 Horizontal Composite MM Fiber Optic/Copper Cabling for Extended Ethernet with PoE

A. For devices that are beyond the distance limitation of UTP cabling and require PoE to operate such as IP surveillance cameras and wireless access points the Contractor, as noted on the drawings, shall provide a composite 2-strand OM3 MM fiber optic cable with an 18 awg 4-conductor stranded copper cable for power within a single jacket. The Contractor shall provide 12 awg 4-conductor when required based on distances and voltage drop.

B. Provide SC, ST or LC connectors has required for the application and devices the fiber will be connecting to.

C. All pre-terminated and field terminated fiber shall be tested and certified with an OTDR and meet OM4 standards.

D. Provide plenum, riser or OSP rated cable as required for the application.

E. Manufacturer:
    1. Panduit
    2. Or FBISD approved equal

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Twisted Pair Test Equipment

A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.

C. Test equipment shall:

1. Be capable of certifying Category 6 and 6A permanent links.
2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.
3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
4. Include S-band time domain diagnostics for NEXT and return loss.
5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.
6. Include a library of cable types, stored by major manufacturer.
7. Store at least 1000 Category 6 or 6A autotests in internal memory.

D. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.

E. The approved manufacturer of the test equipment is Fluke and JDSU/Viavi.

3.03 Training

A. Refer to Section 27 00 00 for additional requirements.

3.04 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.05 Station Cabling

A. Information outlet cables with copper media (voice & data UTP and "TV" coax) shall be located as detailed on the Project Drawings.

B. The Contractor shall utilize these documents in determining materials quantities and routing.

C. Station cables shall be run to the information outlet from the telecommunications room serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.

D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.

E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295', this Contractor shall route the cabling to another telecommunications room or determine shorter path so cables are under 295'. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.

F. All cables shall be installed splice-free unless otherwise specified.

G. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

H. Avoid abrasion and other damage to cables during installation.

I. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

J. Where installed free-air, installation shall consider the following:

    1. Cable shall run at right angles and be kept clear of other trades' work.

    2. Cables shall be supported according to code, using "J-hooks" anchored to ceiling concrete, walls, piping supports, or structural steel beams.

    3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4x the cable diameter).

    4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.

K. Cable shall never be laid directly on the ceiling grid.

L. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

M. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

N. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

O. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

P. To reduce or eliminate EMI, the following minimum separation distances from ≤480V power lines shall be adhered to:

1. Twelve (12) inches from power lines of <5-kVa
2. Eighteen (18) inches from high voltage lighting (including fluorescent)
3. Thirty-nine (39) inches from power lines of 5-kVa or greater
4. Thirty-nine (39) inches from transformers and motors

Q. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

3.06 Information Outlet

A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:

1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.
2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements for both front and side reach access.

C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

3.07 Elevator Interface

A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.

1. The Contractor shall provide an elevator telecommunications junction box located outside of the Elevator Machine Room, for interface of telecommunication cable to the elevator cab(s). This requirement complies with

ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.

2. Telecommunications J-box shall include a keyed lockable door. Additionally, the J-box shall have proper punch down blocks and data jacks suitable for terminating all cables within the J-box.

3. The Contractor shall provide any voice/data cables to this enclosure as required.

4. Electronics or cable for other systems such as security shall not be placed within this enclosure.

5. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.

6. Cables entering the elevator telecommunications J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

3.08 Cable Termination

A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.

B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

C. Provide a 10’ service loop in the MDF or IDF and 10-foot of slack at the conduit stub-up above the outlet. Slack at the outlet location shall be in a U-shaped configuration, not a true loop.

D. Cable bundles shall be secured with Hook-and-loop tie-wraps.

E. Cable Termination – Data/Voice UTP

1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.

F. Cable Termination – Fiber Optic

1. All fibers shall be terminated using the specified connector type.

2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

3. All couplings shall be fitted with a dust cap.

4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

6. If the cable is armored the Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

3.09 Test Data – Copper Media

A. Provide cable records for the Structured Cabling System as installed to include a list of all horizontal and backbone cables produced in an Excel format and provided in hardcopy and electronic format indicating cable number, unique cable label, cable type, origin and destination, length, termination method, and pass/fail result.

B. Provide (3) hard copies of all test results for each cable, to include technician’s name and date stamp, a list of tested cables, and the individual results for each cable tested. Test results shall be furnished on CD ROM to include native file format and .PDF format.

3.10 Copper Station Cables

A. Station cabling testing shall be from the jack at the outlet in the work area to the patch panel on which the cables are terminated.

B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.

D. Horizontal “station” cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.

E. Testing of the cabling systems rated at TIA Category 6/6a and above shall be performed to confirm proper functioning and performance.

F. Testing of the transmission performance of station cables (Category 6/6a) shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss or ACRF
8. PSEFEXT Loss or PS-ACRF
9. Propagation Delay
10. Delay Skew
11. Return Loss

G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

1. CATEGORY 6 (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFEXT Loss Pair to Pair (dB)	PSELFEXT loss (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFEXT Loss Pair to Pair (dB)	PSELFEXT loss (dB)
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2

2. CATEGORY 6a (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2
300.0	32.7	34.0	31.4	14.6	11.6
400.0	38.5	29.9	27.1	12.1	9.1
500.0	43.8	26.7	23.8	10.2	7.2

I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.

J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.

K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

End of Section

Section 27 16 00 – Communications Connecting Cords

Part 1 - General

1.01 Scope

A. This section describes the products relating to high quality Category 6/6A voice and data patch cords.

B. In this section the term patch cords refers to the cords that connect Owner provided data network electronics to the horizontal cable infrastructure.

C. It is important that the horizontal cable system and the provided patch cords work as one complete system for guaranteed channel performance. Patch cords shall be manufactured by the same manufacturer as the jack and patch panels.

D. The Contractor shall provide and deliver all cords as listed in this section. The Owner will be responsible for installation of cords.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 18 00 – Communications Labeling and Identification

J. Section 27 40 00 – AV/Multimedia General Requirements

K. Section 27 41 00 – Audio Visual Systems

L. Section 27 51 00 – Distributed Communications Systems

M. Section 27 60 00 – Physical Security General Requirements

N. Section 27 62 00 – Electronic Access Control System

O. Section 27 64 00 – Video Surveillance System

P. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Category 5E, 6 and 6A Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All patch cords shall be round and consist of eight insulated 23 AWG (24 AWG for Cat 5e), stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels). Cords shall be highest quality patch cords available by connectivity manufacturer.

F. The patch cords shall match the Category rating of the jack and cable it will be connecting to.

G. This Contractor shall provide the following patch cords:

H. At TR, 1 per data cable installed, for each system type, plus 25% spare.

1. Coordinate patch cable lengths with FBISD IT.

I. At station outlet, 1 per data outlet , for each system type, plus 25% spare:

Color	Length
BLUE	10 feet
GREEN	10 feet
ORANGE	10 feet
Exterior	OSP- rated

2.03 Fiber Optic Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All MM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Aqua jacket.

2. Have LC-LC connectors with straight thru connectors (A-A Polarity).

3. Have 50-micron OM3 core.

C. This Contractor shall provide the following patch cords (for pricing purposes only; see section 3.04 below):

Qty	Length	Notes
12	3 meter	MM Non-Plenum

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Ordering and Delivery

A. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors and quantities.

B. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

END OF SECTION 27 16 00

Section 27 18 00 – Communications Labeling and Identification

Part 1 - General

1.01 Scope

A. This section describes the products and execution requirements relating to labeling of telecommunications cabling, termination components, and related subsystems. Covered systems include the following:

1. Equipment room backboards and equipment racks
2. Station cable and terminating equipment
3. Telecommunications grounds and related components

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 16 00 – Communications Connecting Cords

J. Section 27 40 00 – AV/Multimedia General Requirements

K. Section 27 41 00 – Audio Visual Systems

L. Section 27 51 00 – Distributed Communications Systems

M. Section 27 60 00 – Physical Security General Requirements

N. Section 27 62 00 – Electronic Access Control System

O. Section 27 64 00 – Video Surveillance System

P. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

1.09 Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Labels

A. Coordination with and approval by the FBISD Design Manager and FBISD IT Department is required on the specific site labeling schema.

B. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

C. Characters on all labels shall be black printed on a white background.

D. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

E. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

F. Labels used to identify innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information. An example of a compliant product is VIP Products’ “Caution Write-On Coverall Tag.”

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 General

A. The Contractor shall match the Owner's standard labeling scheme.

B. Clean surfaces before attaching labels.

C. Cables shall be labeled identically at both ends.

D. Install all labels firmly. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

E. MDFs and IDFs Room shall be labeled (signage) with the permanent room designations that match the final building signage for cable labeling.

F.

3.05 Labeling of Cabling and Terminations Components

A. Equipment racks in each MDF or IDF shall be labeled in sequential numeric order. Labels shall be centered on the top front of the equipment rack.

B. Character height shall be 1-inch (minimum).

3.06 Cabling

A. Horizontal cables shall have a machine generated wrap around cable label within 1" of termination point inside the MDF/IDF and withing 3" of the termination point at the workstations end. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25" (minimum). Label shall contain destination end, rack number, Patch panel number, and port number (i.e. IDFC126-R1-B5)

B. Horizontal cables shall be labeled identically at each end with the destination end and rack number, patch panel number, and port number. (i.e. IDFC126-R1 -B5).

C. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5" (minimum). Label shall

contain origin room number, destination room number, and cable pairs (i.e. MDFa150-IDFC126-001-025)

3.07 Fiber Optic Backbone Riser Cables and Terminations Components

A. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable. (i.e. MDFA150-IDFC126-12MM-001-012)

B. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

C. Backbone Fiber and Copper Cables shall be labeled within 12 inches of the visible end of the jacket.

D. Fiber Innerduct shall be labeled within 12 inches of the point of entry of the fiber optic enclosure.

3.08 Copper Backbone Cable

A. Copper backbone cable labels shall contain the cable origin room number, the cable destination room number, and cable pairs (i.e. MDFA150-IDFC126-001-025).

3.09 Standard Information Outlet (SIO) Faceplates

A. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, and the data port number(s) on the data patch panel(s).

B. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

C. Station cables shall be labeled within 3” of the cable end.

3.10 Data Patch Panels

A. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel above the port (manufacturer labeled ports 1 through 48) and the room number below the port. Each rack shall start with data patch panel ‘A’ and continue through the alphabet, not repeating in the same rack.

B. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording

the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

C. Refer to Telecommunication “T” Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

3.11 Fiber Optic Cable and Termination Components

A. Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. MDFA150-IDFC126-12MM-001-012).

B. Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting MDF and/or IDF the cable comes from, and strand number to and from respectively (i.e. IDFC126-12MM-001-012).

C. Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.

3.12 Ground System Labeling.

A. All grounds shall be labeled within 3” of the termination point indicating Busbar and other attachment locations. Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

3.13 Conduit Labeling

A. Conduits shall be labeled at the point of entry of the conduit into a room, manhole or pull box.

END OF SECTION 27 18 00

Section 27 40 00 – AV Multimedia General Requirements

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. Successful bidder shall provide, install, configure, and provide warranty service for audiovisual systems, including displays, audio/video/graphics switching and distribution systems, integrated control systems, and other equipment as described herein.

C. Full system functionality must be maintained during additions and renovations in unaffected areas.

D. Remove and disconnect abandoned AV equipment. Remove any abandoned cabling above ceilings and patch wall and floor penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

E. Prior to the audiovisual equipment installation, Contractor shall complete two (2) mockup classrooms meeting the requirements of the construction documents. The classroom mock-up shall consist of TWO reviews to be conducted at different times. The first Mockup shall be to review conduit pathways for the end-point devices. The second mockup will be conducted much later in construction and will be to review system functionality. Classrooms shall be selected by the Owner. Audiovisual equipment installation shall not commence until mock-up rooms have been complete and the owner's design manager and consultant have given written approval.

1. Functionality Mockup is also necessary when performing multiple deployments of a given similar system i.e. multiple conference rooms, collaboration areas, cafeterias, gymnasiums, etc.)

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 41 00 – Audio Visual Systems

1.03 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 Definitions

A. HDCP: High-bandwidth Digital Content Protection or a security protocol designed to limit unauthorized use of protected content. Where applicable, HDCP compliant devices shall be utilized per design specifications. Use of HDCP compliant systems designed herein is the responsibility of the end user and compliance with Owner's Fair Use policies.

B. EDID, E-EDID: Extended Display Information Data, Enhanced-Extended Display Information Data or a remotely readable (read by a source) data file that resides in a display or specialized audiovisual device – commonly referred to as a "sink" – describing the capabilities of the sink to a connected source.

C. Configuration: the software and firmware programming that defines and creates the functionality, levels, presets, and settings of devices.

D. Configure: To define functionality, levels, presets, and settings of device(s) using software and/or firmware.

E. Programmer: Contractor personnel engaged in developing the configuration of systems.

F. DSP: Digital Signal Processing, or Digital Signal Processor.

G. AEC: Acoustic Echo Cancellation.

H. Fixed Architecture: Referring to software providing fixed processing paths with adjustable processing objects in a predetermined sequence.

I. Open Architecture: Referring to software providing infinitely variable Programmer selected processing paths with adjustable processing objects arranged in any sequence deemed appropriate by Programmer.

1.05 Reference Standards and Codes

A. Giddings, G. H. Philip. *Audio Systems – Design and Installation*.
Focal Press, 1990.
Focal Press, Elsevier Inc.

30 Corporate Drive, Suite 400
Burlington, MA 01803

B. *AV Installation Handbook, Second Edition.*
InfoComm International, 2009.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030

C. *Audiovisual Systems Performance Verification (ANSI/Infocomm 10:2013)*
InfoComm International, 2013.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030
http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35975.htm

D. *Dashboard for Controls Template, Design Reference, and Integrators Guide.*
InfoComm International.
www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35324.htm

E. Copyright Act of 1976
U.S. Copyright Office
101 Independence Ave. S.E.
Washington, DC 20559
Phone: (202) 707-3000

1.06 Qualifications

A. Contractor shall have a minimum of 5 years of relevant experience

B. Contractor shall have completed three (3) successful installations of equivalent systems at different school district(s) buildings. To qualify as a valid installation, the projects must be similar in cost, scope, and complexity.

C. The contractor's project team (project engineer, project manager, site lead/superintendent) shall possess two or more of the following certifications in good standing:

1. CTS (InfoComm International)
2. CTS-I (InfoComm International)
3. CTS-D (InfoComm International)

D. An AVIXIA (Infocomm) CTS-I technician will be on site at all times to supervise any and all audiovisual work being performed.

E. 10.5 The AVIXIA (Infocomm) CTS-I technician will be present at the following meetings.

1. Low Voltage Preinstallation Meeting
2. Audiovisual System Pathway Mockup

3. Audiovisual Systems Functionality Mockup (Needed when performing multiple deployments of a similar system, i.e., multiple conference rooms, collaboration areas, cafeterias, gymnasiums, etc.)
4. Owner walks /System inspections
5. Coordination Meetings
6. Substantial completion punch
7. 11-month warranty
8. And Other events as requested by the Owner

F. Contractor shall provide 24-hour support, 7 days a week, within 2 hours during regular business days and 4 hours during non-business hours during the warranty period. Contractor shall expect any corrective work to be performed during non-business hours or after school hours.

G. DSP and Automation/Control Systems Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer-approved training in configuring the DSP and Automation/Control systems being provided and interfaced with.
2. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) for the DSP and Automation/Control systems hardware being provided and/or being programmed.
3. At minimum, the awarded contractor shall possess:
    a. For Audinate: Dante Level 2 Certified (required), or Level 3 (preferred).
    b. For QSC: Q-SYS Level 2, Q-SYS Control 201, and Q-SYS Quantum Certified

H. Control System Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer-approved training in the configuration of the integrated control systems being provided.
2. Certification: Programmer shall hold the applicable manufacturer programming certification(s) or be an authorized independent programmer of the integrated control systems.
    a. For AMX: AMX Certified Expert
    b. For Crestron: Crestron Certified Programmer
    c. For Extron: Extron Control Professional
    d. Or approved equal

I. Refer to subsequent sections for section specific qualification requirements.

1.07 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements

B. Structurally Mounted Elements: Including but not limited to monitors, projectors, projection screens, and loudspeakers.

C. Frequency Assignment Plans: Provide for all wireless microphones.

D. Custom Engraving: Layout and labeling/engraving of custom products including wall plates and interconnection panels. Provide engraving detail with material and finish detail.

E. Power Distribution: Plan for distribution and switching of AC and DC power to all audiovisual devices, including sequencing order of outlets and banks. Time delay to be field configured as necessary for proper system power up and down.

F. Colors: Confirm color option selections with Architect per location for items such as speakers, projectors, plates, etc.

G. Layouts of physical and virtual user controls in graphical format. This shall include:

1. Engraved buttons and overlays

2. Machine-printed adhesive labels

3. Graphical user interfaces for touch panels or web interfaces

4. Descriptive write-up of function(s) of each button for each page.

H. Copy of manufacturer configuration software, or link to manufacturer website download page for accessing configuration software.

1. Version: Submitted software shall be identical version used to create Audio DSP configuration.

I. Integrated control system review shall be done via web conference with Consultant.

J. Contractor shall make changes as requested by Consultant in pre-construction submittal review.

1.08 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.09 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

1.10 Correction Period

A. Length of Period: Contractor shall offer a one year correction period to Owner for this system. Contractor shall repair all equipment and cabling problems at no additional cost to Owner during the correction period.

B. Commencement: Correction period shall begin at date of Final Acceptance.

C. Final Acceptance: shall be defined as the date at which all contract work (save for a correction period) is complete, including punch list completion & verification, closeout submittals, and written verification by the Owner is obtained by the Contractor that the systems have been accepted.

D. Response: Contractor shall respond by phone within two (2) hours to calls for service or assistance from Owner during normal business hours for the duration of the correction period.

E. On-site Response: Contractor shall respond on-site within eight (8) business hours from the time of the initial phone contact in the event that the issue cannot be resolved over the phone.

F. Equipment on Loan: Contractor shall loan equipment for any broken, defective, or non-functional equipment that cannot be repaired and returned within one week. Contractor shall provide shipping, delivery, and integration at no additional cost to Owner. Equipment shall be comparable in size, speed, brightness, and relevant performance specifications, as determined by Owner.

G. Projection Lamps: Projection lamps are to be warranted by Contractor for a minimum of 90 days, or the rated life expectancy of the lamp, whichever comes first.

H. Damaged Equipment: Equipment that is damaged due to intentional misuse, abuse or negligence is not covered under this warranty; however, Contractor shall assist Owner in putting the system back in working order in the shortest possible timeframe while charging normal service rates for labor and equipment.

1.11 Ownership

A. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a “work made for hire” within the meaning of Section 201 inventions of the Copyright Law of 1976.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Product Specifications

A. Provisions: Product specifications are provided in subsequent sections to Contractor for the appropriate configuration and/or provision of accessories as well as for a guide to indicate key features for possible substitutions.

B. Where wireless microphone systems are specified, Contractor shall determine optimal frequency range for final product selection and submit Manufacturer's recommended frequency band for Owner and Consultant approval prior to ordering equipment. Contractor shall provide congruent frequency band products where like systems are specified for interoperability of components. Where three (3) or more wireless microphones are specified within the same system, Contractor shall provide and install necessary antennae distribution for optimal performance, to be submitted for Owner and Consultant approval during pre-construction phase.

C. Interconnections: Contractor shall be responsible for providing populated, grommeted, or blank cover plates for all wall and floor box openings intended for audiovisual systems.

D. Twisted Pair (TP) Category Cabling: Contractor shall use twisted pair Category cable as recommended by manufacturer of transmission equipment for optimal bandwidth and signal timing. Where cable type is not specified by manufacturer, Contractor shall use shielded twisted pair Category 6 cabling. Cable type shall be detailed in pre-construction submittals with any deviations from manufacturer recommendations expressly noted.

E. Mounts: Contractor shall fabricate mounts for projectors, monitors, loudspeakers, cameras, etc. as necessary, and shall modify standard mounts as required for optimal mounting configurations. Intended hardware shall be detailed in shop drawing submittals.

1. Custom mounting configurations shall be submitted in shop drawings for review.

2. Contractor shall provide all hardware as necessary, including flanges, Unistrut, threaded pipe, column extensions, yokes, clamps, threaded rod, aircraft cable, and any other hardware required to securely mount equipment.

3. All ceiling tile penetrations shall be neatly finished with a plate, grommet and/or escutcheon ring.

2.03 Miscellaneous Material

A. Required Equipment: Contractor shall provide additional system components typically and reasonably required to make system operational even though not specifically indicated in Drawings, Appendices or Specifications including, but not limited to, cable, connectors, connecting accessories, adaptors, power supplies, power strips, rack mounting adapters and shelves, cover plates and closure panels, relays and switches, remote antenna mounts, terminal blocks, and related connector and termination hardware required by but not supplied with the equipment.

B. Blank Fill Panels: Contractor shall provide blank fill panels to cover any openings in equipment racks provided under this contract whether specified in the equipment schedules or not. Fill panels shall match finish of specified rack hardware.

C. Power Distribution Strips: Contractor shall provide power distribution strips as necessary for distributing power within equipment racks and consoles. Strips shall be UL listed, be securely mountable, and appropriate for professional installation.

D. Wall Openings: Contractor shall provide blank faceplates to cover any unused openings within the project area. Faceplate type and finish to match electrical outlets in the project.

E. Input Cables: Contractor shall provide all interconnection cables shown on the project drawings, as well as end-user input cables at all locations where laptops and other user devices are intended to be connected.

F. Keys: Keys for like equipment shall be identical.

G. Wireless Transceivers: Where wireless transceivers are specified (including, but not limited to wireless microphones, wireless assistive listening devices, etc.) Contractor shall verify frequency band range of existing Owner wireless systems. Contractor shall provide wireless transceiver system(s) compatible with existing equipment for interoperability.

H. Cable Sleeving:

1. Shall be black expandable sleeving, with ends neatly turned under 2”, held in place either by nylon tie-wrap, or heat-shrink tubing. Tie wraps, if used, shall not deform cables within the umbilical. Cables requiring sleeving include:

    a. Exposed cabling outside of wire management in console furniture.

    b. Cable umbilicals connecting to or from wall, floor, or ceiling plates consisting of more than one wire.

2. Contractor shall coordinate as necessary so that all low-voltage cabling (including Ethernet) are included in a single umbilical

2.04 Power Devices

A. Refer to Section 27 00 00 for additional requirements.

B. All large venue audio amplifiers shall be on sequenced outlets.

2.05 Fire Stopping Materials

A. Refer to Section 27 00 00 for additional requirements.

Part 3 - Execution

3.01 Equipment

A. As required by Section 27 00 00.

1. Safety: Contractor shall use proper structural installation techniques and maintain a minimum 5:1 safety margin.

2. Custom Mounting Finish: Custom mounting hardware shall be painted by Contractor to match either color of wall, ceiling or equipment, at Consultant's discretion.

3.02 Interconnection

A. As required by Section 27 00 00.

1. Interpretation: Contractor shall make system interconnections as indicated on Drawings and specified herein. Contractor shall interpret Drawings using an understanding of the equipment and general system topology (both existing and future/specified). Contractor shall provide power and control lines to and from power supplies, remotely controlled equipment and other devices even though not explicitly indicated on Drawings or listed in equipment tables.

2. Additional: Contractor shall be responsible for associated equipment signals not specifically documented in provided drawings. These include synchronizing signals, transmitting and receiving antennas, and LAN connections to equipment provided and/or installed by Contractor.

3. Mass Notifications: Contractor shall ensure that audio systems are appropriately managed by emergency notifications so that emergency notifications are not impeded by the audio system.

3.03 Cable Management

A. As required by Section 27 00 00.

1. Above Ceiling: Cabling located above ceilings shall be tied off to and supported by ceiling supports or other structures at a minimum of eighteen (18) inches above the ceiling.

2. Not on Ceiling: Cabling shall not lie on the ceiling.

3. Wall Cabling: Cables installed in a horizontal fashion along wall surfaces shall be installed in surface raceway approved by Owner and Consultant.

4. Floor Cabling: Cabling placed at floor level such as microphones shall be installed on the floor in the shortest possible route to the nearest wall considering traffic patterns and in an enclosure designed for that use and offering protection from foot traffic.

5. Desk Cabling: Where a cable is installed inside desk furniture, a means of protecting the cables and holding cabling to a fixed surface shall be installed.

6. Grommets: Holes in horizontal furniture surfaces for cable pass-through shall be provided with appropriate sized grommet. Grommet shall be black unless otherwise specified or required.

7. Stub-ups: Where conduit is stubbed-up through the floor and exposed, Contractor shall wrap cables with black expandable sleeving and secure at least three (3) inches below level of conduit top.

    a. Where conduit is stubbed-up through floor and concealed within furniture, Contractor shall install tether comprised of aircraft cabling to limit the distance furniture may be moved away from stubbed-up conduit. Cabling service loop exiting stubbed-up conduit and entering furniture shall be longer than the corresponding tether, providing protection against movement of furniture that would otherwise damage installed cabling.

8. Umbilicals: Exposed cable umbilicals, such as those between instructional furniture and a floor- or wall-mounted plate, shall be covered in black expandable sleeving, with neatly finished ends (heat-shrink or Consultant-approved method).

3.04 Connector Termination

A. As required by Section 27 00 00.

1. Video Connectors: Video connectors (BNC, RCA, and F) shall be terminated using a crimp tool or dies designed specifically for the connectors being applied.

2. XLR Connectors: Terminate XLR type connectors wired pin 2 high, pin 3 low, and pin 1 shield.

3. UTP: UTP cable shall be terminated with appropriate crimps tools or tools specified by manufacturer.

3.05 Grounding

A. Audiovisual equipment racks shall be grounded to the telecommunication grounding system with a minimum 6 AWG grounding cable. Refer to Section 27 00 00 for additional grounding requirements.

3.06 Testing & Inspection

A. General Information: As required by Section 27 00 00.

B. Notification: Prior to start of testing, provide a list to Consultant of test equipment make, model numbers and calibration dates that will be used.

C. Testing: Contractor shall perform complete testing on system before inspection. Selected systems may be retested during inspection at Owner's discretion.

D. Display/Output checks: Contractor shall verify that visual and audio outputs from the system are high-quality and without noticeable distortion or feedback at normal operating levels.

E. Wiring and Labeling: Contractor shall check all inputs and outputs for correct wiring and labeling.

F. Loudspeakers: Contractor shall measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz. For band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting results, Contractor shall include the calculated impedance based on number of units on a line and the size and distance of the run. Contractor shall correct any field readings that differ more than 20% from the calculated impedance. Contractor shall use an electronic polarity checker to test each reinforcement speaker. Speakers shall have the same relative polarity.

3.07 Computer Graphics

A. Computer graphics shall be crisp and focused with respect to color alignment. If color alignment is not registered properly, Contractor shall identify source of problem and correct. EDID and other auto-registration features shall be set within AV equipment where required for optimal system performance.

3.08 Training

A. General Information: As required by Section 27 00 00 and following section(s).

B. 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.

C. Provide for (2) hours of training on each system at the "End User" level covering basic functions and operation of the system. Multiple training sessions will be required to provide for training of all faculty at each campus.

D. Training shall be conducted on-site with a manufacturer's representative.

1. Training should be scheduled at least 3 weeks prior to students returning to school when possible or no more than 1-2 weeks after punch sign off, whichever comes first.

2. Training schedule shall be coordinated with GC, FBISD Design and Construction PM, and FBISD IT departments to ensure the training scheduled when the end users are on contract and available

E. Training / demonstration shall provide for a "user's manual" written for the school personnel onsite, for operations of the system. A "Quick Start" guide shall also be

provided as a supplement to the “user manual” offering condensed instructions of the system

F. As part of the “user manual”, a recorded video of system function and use will be provided to FBISD for training others not present at training or for reinforcement of training of the school staff.

3.09 Project Closeout

A. Completion: System shall be considered complete when all of the following has occurred:

1. Testing has been completed to the satisfaction of the Owner and Consultant.

a. Provide a test report showing the system has been 100% tested and is 100% operational prior to training/demonstration—reference Index for sample test report.

2. Punch-listed items have been addressed to the satisfaction of Owner.

3. As-built drawings and system documentation has been turned over to Owner and Consultant.

4. Complete operational training has been conducted with Owner’s staff.

5. System Commissioning Process has been completed.

B. Acceptance: Contractor shall secure written Acceptance of systems in the form of authorized Owner signature on Acceptance Document. This shall constitute the Date of Acceptance.

End of Section

Section 27 41 00 – Audio Visual Systems

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. Provide audiovisual systems, training, and warranty services for those systems as described herein.

C. Full system functionality must be maintained during additions and renovations in unaffected areas.

D. Remove and disconnect abandoned AV equipment. Remove any abandoned cabling above ceilings and patch wall and floor penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 40 00 – AV/Multimedia General Requirements

1.03 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 40 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 Correction Period

A. General Information: Products shall be covered by Contractor correction period as required by Sections 27 00 00 and 27 40 00.

B. Correction Period: Contractor's obligation for correction period shall not abrogate manufacturers' warranty periods.

C. Commencement: Correction Period begins on Date of Acceptance.

1.05 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

1.06 Pre-Construction Submittals

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in 27 40 00 Part 1, including AVIXA CTS/CTS-I/CTS-D, control system programming certifications, digital signal processor certifications, Dante certifications, and any other certifications necessary to purchase and install the specified products.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

2. Provide a separate schedule of materials for each system or room type.

D. Color Selection List

1. Provide a list of all audiovisual equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to speakers, projectors, projection screen cases, cameras, antennas, control panels, input plates, microphones, ceiling enclosures, wall enclosures, specialty furniture, monitor arms, cable cubbies or grommets, rigging, mounts, and wireless access points.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. Provide a separate list for each room type. The same product may require a different color in different rooms to match the aesthetics of the space.

4. The AV Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible

after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device's color and require that the Contractor replace it at no cost to the Owner.

E. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

F. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Equipment Rack/Cabinet & Wall Equipment Elevations: Include placement of all rack/cabinet or wall-mounted equipment, drawn to scale.

d. Structurally Mounted Elements: Include a plan view of placement and a detail of the structural mounting techniques to be used.

e. Furniture: For all Contractor-provided furniture, include dimensional drawings, cable management, and finishes with samples for Owner approval.

1.07 Construction Progress Submittals

A. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor

shall provide additional information when required by the Owner to assist them in assigning IP addresses.

B. Touch Panel Layouts

1. Provide a submittal with proposed touch panel page layouts. Include notes that narrate the functionality of each button.

2. Include separate layouts for each differing room type.

3. The Consultant shall review this submittal first and may require resubmittals to address concerns. Once the layouts are acceptable to the Consultant, the Contractor shall meet with the Owner and Consultant and present the touch panels for the Owner's consideration.

4. Approval of the touch panel layouts does not exempt the Contractor from making additional changes once the system is installed. The Owner reserves the right to request additional changes to the system programming and graphical user interface (GUI) for three (3) months after the initial system training, and the Contractor is required to make these changes at no additional cost to the Owner.

1.08 Ownership

A. General: Upon completion of the project, all programming and configuration of control hardware, touch panels, and other devices shall be the property of the Owner.

B. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a "work made for hire" within the meaning of Section 201 inventions of the Copyright Law of 1976.

C. No Passwords: Contractor shall not use any passwords to prevent access to code files except as specified herein.

1.09 Turn-Over Cables

A. Contractor shall provide an end-user input cable for every wall plate connection or other end-user input location.

B. Turn-over cables shall match the quality and requirements of the main cable run for that signal type; refer to 27 40 00.

C. Turn-over cables shall be 10-feet in length except where noted otherwise or where required for system functionality.

1.10 Manufacturer Coordination

A. Contractor shall contact the manufacturer(s) to obtain master quote information if available. Master quotes often contain additional products that may not explicitly appear in the specifications.

1.11 System Descriptions

A. General

1. This specification describes the general system types/locations and components, not every connection or room. The technology drawings more fully describe these systems and must be reviewed thoroughly in conjunction with the specification.

2. The technology floor plans indicate AV device locations, including input plates, speakers, projectors, flat panel displays, wall controllers, AV cabinets, etc.

3. The technology schematics (located on the “Technology Details” drawing sheets) indicate AV components in each system type and how they are connected. The components are described generally (ex: “AMPLIFIER”) with the specified model indicated below. Some device model numbers are not indicated in these written AV specifications and must be found on the technology drawing schematics located in the detail sheets. The schematics also indicate specific installation and functional requirements not shown elsewhere.

4. The loudspeaker schedule (located on the “Technology Details” drawing sheets) indicates speaker models and other requirements. It specifies which model speaker shall be provided at each location type by using numbered identifiers that appear on the symbols on the floorplans (ex: “S1” for speaker type 1).

5. The display schedule (located on the “Technology Details” drawing sheets) indicates the anticipated display size for a given location, as well as the intended use and a reference to the associated AV schematic drawing. For example, “FP1” will be defined here to tell you the purpose, size, height, and associated AV system detail that applies anywhere you see an “FP1” symbol on the floor plans. Be aware that a room’s name on the architectural floor plans may not match the system name for the space. Use the flat panel numbers to determine what system is required.

6. Each system description includes a list of anticipated equipment. This list generally describes the type and quantity of major components. For detailed specification requirements regarding these components, refer to Part 2 as well as the AV schematic line drawings. Interconnecting cables are generally not listed as “major components” but are required and assumed to be included.

7. Public Address/Intercom Override

   a. The library system’s audio system will be configured to mute audio during paging events.

   b. Coordination with the PA system contractor will be required.

c. The PA system contractor will provide speaker wire to the paging control relay.

d. The AV Contractor will be responsible for terminating speaker wire at the paging control relay and configuring the paging control relay.

e. Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

f. Paging override applies to the library, gymnasium, cafeteria, band hall, orchestra, choir, fine arts classroom, theater classroom, dance classroom, black box, and weight room audiovisual systems.

B. Classroom Audiovisual Systems

1. The classroom shall feature an Owner-Furnished Owner-Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the onboard selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

2. Audiovisual Sources

a. The classroom Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for Audiovisual connectivity is NOT needed.

b. USB-C Patch cable for the teacher's device is OFOI

3. Audiovisual Infrastructure

a. Classroom Audiovisual Infrastructure shall consist of OFOI localized cabling between the Audiovisual system components.

4. Power Requirements

a. All Audiovisual power requirements shall be coordinated with "Division 26".

b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet, and one (1) Quad power on each of the solid walls. All four to five outlets will be on one dedicated 120V 20A Circuit.

C. Collaboration Area Audiovisual Systems

1. The Collaboration Area shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

2. Display Mounts

    a. An electric-height adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring loaded.

3. Typical Placement of Display in Collaboration Area

    a. The display shall be mounted on the teaching wall in the collaboration space.

    b. The display mounting height shall be situated in such a way that in the lowered position, the display is ADA compliant.

    c. Display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display type with FBISD.

4. Power and AV Pathway Requirements

    a. All audio-visual power requirements shall be coordinated with "Division 26".

    b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.

5. Audiovisual Sources

    a. The Collaboration Area Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for Audiovisual connectivity is NOT needed..

6. Audiovisual Infrastructure

    a. Collaboration Area Audiovisual Infrastructure shall consist of OFOI localized cabling between the audiovisual system components

D. Medium and Large Conference Room Audiovisual Systems

1. Medium and Large Conference Rooms are defined as conference areas with seating for over five (5) people.

2. Medium and Large Conference Rooms shall feature an Owner-Furnished Owner-Installed (OFOI) Interactive Flat Panel Display. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the onboard selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

3. 3.3 Display Mounts

    a. An electric height-adjustable mount shall be provided through the construction contract. Electrified mounts shall not be spring-loaded.

4. Typical Placement of Display in Medium and Large Conference Rooms

    a. The display shall be mounted on the teaching wall in the Conference Room. Teaching wall is typically the 'shorter' wall in a rectangular-shaped room

    b. The display mounting height shall be situated so that the display is ADA compliant when lowered.

    c. Display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display types with FBISD.

5. Power and Requirements

    a. All Audiovisual power requirements shall be coordinated with "Division 26".

    b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.

6. Audiovisual Sources

    a. The Medium and large conference room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for audiovisual connectivity is NOT needed.

7. Audiovisual Infrastructure

    a. Medium and Large Conference Room audiovisual infrastructure shall consist of OFOI localized cabling between the audiovisual system components.

8. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

E. Small Conference Room Audiovisual Systems

1. Small Conference Rooms are defined as conference areas with seating for less than five (5) people.

2. Small Conference Room shall feature an Owner-Furnished Owner-Installed (OFOI) Interactive Flat Panel Display. Connection to the display shall be accomplished through a local connection on the display. Display control will be done through the native remote or through the onboard selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or an external sound bar.

3. Display Mounts

    a. An electric height-adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring-loaded.

4. Typical Placement of Display in Small Conference Room

    a. The display shall be mounted on the teaching wall in the Small Conference Room. The teaching wall is typically the 'shorter' wall in a rectangular-shaped room.

    b. The display mounting height shall be situated in such a way that, in the lowered position, the display is ADA compliant.

    c. Display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display type with FBISD.

5. Power and AV Pathway Requirements

    a. All Audiovisual power requirements shall be coordinated with "Division 26".

    b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.

6. Audiovisual Sources

    a. The Huddle Room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for Audiovisual connectivity is NOT needed.

    b. USB-C Patch cable for the teacher's device is OFOI.

7. Audiovisual Infrastructure

    a. Huddle Room audiovisual Infrastructure shall consist of OFOI localized cabling between the audiovisual system components.

8. The consulting team shall include a control and basic functionality checklist for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

F. Huddle Room Audiovisual Systems

1. Huddle rooms are defined as small conference areas with seating for up to four (4) people.

2. Huddle Room shall feature an Owner-Furnished Owner-Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the onboard selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

3. Display Mounts

a. An electric height-adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring-loaded.

4. Typical Placement of Display in Huddle Room

   a. The display shall be mounted on the teaching wall in the huddle space. The teaching wall is typically the 'shorter' wall in a rectangular-shaped Room.

   b. The display mounting height shall be situated so that the display is ADA compliant when lowered.

   c. Display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display type with FBISD.

5. Power and AV Pathway Requirements

   a. All Audiovisual power requirements shall be coordinated with "Division 26".

   b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.

6. Audiovisual Sources

   a. The Huddle Room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for Audiovisual connectivity is NOT needed.

   b. USB-C Patch cable for the teacher's device is OFOI.

7. Audiovisual Infrastructure

   a. Huddle Room audiovisual Infrastructure shall consist of OFOI localized cabling between the audiovisual system components.

8. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

G. Principal's Office Audiovisual Systems

1. The Principal's Office System shall consist of a wall-mounted commercial flat panel display and a wall-mounted HDMI input plate. The flat panel display remote control will be used for system control.

2. Elementary School, Middle School, and High School Assistant Principal's Offices shall receive identical systems to the principal's office.

3. Other select administrative spaces as defined by FBISD shall receive displays similar to the displays for the Principal's Office, meeting the requirements noted below

4. The Principal’s Office flat panel display shall be at minimum 55”, with a minimum resolution of 3,840x2,160 and a minimum brightness of 350 nit.
5. Source Interfaces
    a. The display shall have a minimum of two (2) HDMI inputs.
6. Flat Panel Display Mounts
    a. The flat panel display mount shall be a low-profile tilting mount rated for the display's size and weight. The mount shall have tilt and articulating arm features.
7. Typical Placement of Flat Panel Display in Principal’s Office
    a. The flat panel display shall be mounted on the wall designated by the Owner / Architect in the Office.
    b. The flat panel display mounting height will generally be 40 inches from the finished floor to the bottom of the screen.
    c. Flat panel display mounting locations at gypsum walls will receive ¾” plywood in-wall blocking. Blocking will extend 24” vertically and laterally from the center of the mounting point.
8. Power and AV Pathway Requirements
    a. All Audiovisual power requirements shall be coordinated with “Division 26”.
    b. One (1) Quad power is required adjacent to the HDMI input plate.
    c. Flat panel display will receive two 110VAC duplex outlets at the AV back box location
    d. All three outlets will be on one dedicated 120V 20A Circuit.
    e. The multimedia input plate shall receive a 2-1/8” x 4-11/16” wall box with dual gang plaster-ring and bulk cable feedthrough plate. These boxes and associated conduits will be used for routing of AV and network cabling from the accessible ceiling space to the multimedia input plate.
    f. Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will be used to house power, data, AV connections, infrastructure, and any associated AV equipment.
    g. The in-wall storage box will be mounted at 60” from finished floor tovertical center.
    h. The flat panel display will receive two EMT conduits providing a pathway from the in-wall storage box to the accessible ceiling space.
    i. All AV conduit shall be 1.25” EMT.
9. Audiovisual Source

a. The audiovisual systems in the Principal's Office shall display content from one (1) HDMI input plate.

b. One Input plate shall be located at the Principal's desk/computer location.

c. The multi-media input plate shall be an HDMI type that transmits video via HDBaseT protocol.

10. Audio Reinforcement

a. Audio will be played back via the flat panel display's internal speaker.

11. Audiovisual Control System

a. The principal's Audiovisual system will be controlled by the flat panel display's included infrared remote control.

12. Audiovisual Infrastructure

a. Audiovisual Infrastructure shall consist of localized specific cabling between the Audiovisual system's components.

b. Category cabling used for video transmission shall be shielded Cat6A premade patch cables with boots.

c. All cabling shall be plenum-rated.

d. Each office shall receive (1) 10' HDMI Male to Male, high retention, gold-plated, high-quality cable. Cable shall be rated at least 18 Gbps (gigabits per second).

e. All patch cables should be turned over to FBISD IT department at time of system commissioning.

13. Power Requirements

a. One power outlet is required on the wall adjacent to the HDMI input plate.

b. Two Duplex power outlets are required in the in-wall storage box at the flat panel display mounting location.

14. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

H. Digital Signage

1. Typical digital signage locations consist of a commercial-grade wall-mounted flat panel display and a digital signage player.

2. Typical flat panel displays shall be at minimum 55" diagonal with a minimum resolution of 3,840x2,160 and a minimum brightness of 500 nit.

3. Front lobby flat panel displays shall be commercial grade, 65" diagonal with a minimum resolution of 3,840x2,160 and a minimum brightness of 500 nit.

4. Digital signage players will be Owner Furnished; Contractor Installed (OFCI).
5. Flat Panel Display Mounts
    a. The flat panel display mount shall be a low-profile tilting mount rated for the size and weight of the display. The mount shall also feature an articulating arm.
6. Typical Placement of Digital Signage Monitors
    a. The flat panel displays shall be mounted at locations designated by FBISD.
    b. A flat panel display will be located in the administration waiting area.
    c. The flat panel display mounting height will generally be 68 inches above the finished floor to the center of the screen. The exact location and height shall be coordinated with the FBISD Design Manager and FBISD IT.
    d. Flat panel display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will extend 24" vertically and laterally from the center of the mounting point.
7. Power and AV Pathway Requirements
    a. All Audiovisual power requirements shall be coordinated with "Division 26".
    b. Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will house power, data, and AV connections and infrastructure, as well as the digital signage player.
    c. The in-wall storage box will be mounted 68 inches above finished floor to the center of the screen. Exact location and height shall be coordinated with FBISD Design Manager and FBISD IT. Coordinate the display mount with a recessed storage box so the viewer does not see the recessed storage box. The flat panel display mounting height will.
    d. The flat panel display will receive one 110VAC duplex outlet at the back box location. The receptacle will be located within the recessed storage box.
    e. The flat panel display will receive two 1.25–inch EMT conduits providing a pathway from the in-wall storage box to the above accessible ceiling space.
    f. All conduit shall be 1.25" EMT.
8. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

I. Digital Signage - Serving Line/Menu Board Locations

1. Serving line/menu board digital signage locations shall consist of a flat panel display mounted on the wall or ceiling and a digital signage player. Location of display shall be coordinated with FBISD Design Manager, FBISD IT, and FBISD

Child Nutrition departments. The displays should be visible from the queuing lines.

2. Location of display shall be coordinated with FBISD Design Manager, FBISD IT, and FBISD Child Nutrition departments. The displays should be visible from the queuing lines.
3. Each display will have a minimum of two HDMI inputs.
4. Digital signage players will be Owner Furnished Contractor Installed (OFCI).
5. Flat Panel Display Mounts
    a. The flat panel display mount shall be a low-profile tilting or pole mount rated for the display's size and weight. Wall-mount displays will require an articulating arm.
6. Typical Placement of Menu Board Flat Panel Displays
7. Flat panel displays will be mounted above the sneeze guards in the serving line or on the walls. The locations of the displays shall be coordinated with the FBISD D&C Design Manager, FBISD IT, and FBISD Child Nutrition departments.
    a. The displays should be visible from the queuing lines.
    b. Displays must be visible from the entrance to the serving line.
    c. Each serving line shall receive one display.
8. Power Requirements
    a. All Audiovisual power requirements shall be coordinated with “Division 26”.
    b. Each wall-mounted flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. Any ceiling-mounted display shall receive an in-ceiling storage box. The storage box will house power, data, AV connections, infrastructure, and the digital signage player.
    c. The exact location and height of the in-wall storage box shall be coordinated with FBISD Design Manager and FBISD IT Department. Coordinate the display mount with the recessed storage box so the viewer does not see the recessed storage box.
    d. The flat panel display will receive one 110VAC duplex outlet at the back box location. The receptacle will be located within the recessed storage box.
    e. The flat panel display will receive two 1.25” EMT conduits providing a pathway from the in-wall storage box to the above accessible ceiling space.
    f. All conduits shall be 1.25” EMT
9. Data Requirements
    a. At the installation location, each ceiling-mounted flat panel display will receive an above-ceiling data jack. Data jacks shall be terminated within the

ceiling enclosure. If the display is wall-mounted, the data outlet shall be terminated within the in-wall storage box.

J. Library Audiovisual Systems

1. Libraries shall be equipped with ONE (1) Larger Group Instructional Area and ONE (1) Small Group Instructional Area. The Large Group Instructional area shall feature a mounted projector with a motorized screen. The screen will be sized appropriately for the viewing area. The Small Group instructional area shall feature a mobile display. Alternatively, large libraries may have a large format projector, motorized projection screen, and TWO (2) mobile displays.

2. The small group instructional area shall feature an Owner-Furnished Owner-Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the onboard selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

3. Audiovisual Sources

   a. The Small Group Instructional Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the onboard PC. A pathway through the wall from the teacher's location to the display for Audiovisual connectivity is NOT needed.

   b. USB-C Patch cable for teacher's device is OFOI.

4. Audiovisual Infrastructure

   a. Small Group Instructional Area Audiovisual Infrastructure shall consist of OFOI localized cabling between the Audiovisual system components.

5. Power Requirements

   a. All Audiovisual power requirements shall be coordinated with "Division 26".

   b. One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power on each of the solid walls. All four to five outlets will be on one dedicated 120V 20A Circuit.

6. Large Group Instructional Video Display System for Libraries

   a. A 119" or larger (16:10) motorized projection screen will be installed.

   b. A 5,500 lumen WUXGA (or better) projector will be installed in the large group area centered on the projection screen. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

   c. If the projector is not serviceable from a six-foot ladder, it will be mounted using a motorized projector lift capable of allowing it to be serviced from the floor without a ladder. The lift will also accommodate a projected image with NO GEOMETRIC CORRECTION within the projector lens shift capability.

The projector and projector lift will require a shared dedicated 120VAC 20A circuit.

d. Coordinate with FBISD Design Manager and FBISD IT if a fixed pole must be used due to structural, mechanical, or architectural features.

e. Coordinate with FBISD Design Manager and FBISD IT if geometric correction of the projected image is necessary.

f. The designer shall design the projection system to the space.

7. Audiovisual Sources

   a. The library area's Audiovisual systems shall display content from an HDMI wall plate. The wall plate input shall be an HDMI Wall Plate Transmitter.

   b. A 3.5mm analog audio wall plate will be collocated with the HDMI wall plate.

   c. The 3.5mm analog audio plate shall be connected to the amplifier via a "balun" or balanced audio transformer set.

   d. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. The current design basis is Extron DTP HWP 4kD or the current equivalent.

8. Audio Reinforcement

   a. The audio content from the source device will be de-embedded from incoming HDMI signals and provide a line-level analog audio source that will be amplified for playback over a minimum of two (2) in-ceiling loudspeakers. Audio content shall be available for broadcast through the system without the projector being on. An audio sensing relay will mute the audio during paging/intercom events. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. The current design basis is Radio Design Labs (RDL) Paging Controlled Relay TX-PSD1 or current equivalent.

   b. The amplifier will be compact, stereo or mono, and capable of producing 25 watts per channel. Space and size will determine amplifier quantity requirements. The amplifier will feature terminal connections for analog volume and mute. Coordinate the current preferred equipment selection with FBISD Design Manager and FBISD IT.

   c. Each library will receive a minimum of two (2) in-ceiling mounted loudspeakers. Spaces with open ceilings shall receive wall-mounted or hanging pendant speakers. The number of speakers will be determined by the space size requirements.

   d. Speakers will be two-way, capable of low impedance (8 ohm or 70V) operation with integral back cans and a minimum power handling of 30 Watts Continuous Pink Noise.

e. Libraries with lay-in acoustic tile ceilings will receive 2'x2' square drop-in loudspeakers.

f. Libraries with open ceilings will receive pendant-style loudspeakers.

g. Loudspeakers shall be UL2043 listed.

h. Coordinate the current preferred equipment selection with the FBISD Design Manager and FBISD IT.

9. Control System

a. The Projection system shall be controlled by a wall-mounted controller that provides the instructor with direct control over power, volume, and input sources.

b. The control functionality shall provide for Projector On/Off, Input 1, Input 2, and Volume Control Up/Down.

c. The wall-mounted controller shall be located at the presenter's input HDMI location. If not possible, the location shall be coordinated with FBISD Design Manager and FBISD IT.

d. The controller shall be mounted at 48" above finished floor (AFF) to its vertical center.

e. The wall-mounted controller shall be a push-button style system.

f. The controller will communicate via RS-232 between the controller and projector.

g. Acceptable manufacturers for the controller shall be Extron or FBISD Design Manager approved equal.

h. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

10. Equipment Storage

a. The large group areas with ceilings lower than 12'-0 shall receive a 1'x2' in-ceiling plenum storage enclosure. The enclosure will include two (2) A/V component shelves and an active cooling fan.

b. The Large group areas with 12'-0" or higher ceilings shall receive a lockable recessed in-wall storage enclosure. The enclosure will include two (2) A/V component shelves or mounting plates and an active cooling fan.

11. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

12. Audiovisual Infrastructure

a. Audiovisual Infrastructure shall consist of localized specific cabling between the Audiovisual system's components.

b. Category cabling used for video transmission shall be shielded Cat6A premade patch cables with boots.

c. All cabling shall be plenum rated.

d. Each library area shall receive (1) 10’ HDMI Male to Male, high-retention, gold-plated, high-quality cable. Cable shall be rated at least 18 Gbps (gigabits per second).

e. Each Library system shall receive (1) 6’ 3.5mm audio Male to Male cable.

f. All patch cables should be turned over to FBISD IT department at the time of system commissioning.

13. Power Requirements

a. One quad power outlet is required on the wall adjacent to the HDMI input plate.

b. One quad power outlet is required at the projector mounting location and terminated within the ceiling storage box for ceilings 12’-0” or lower or in an in-wall recessed storage box.

K. Gymnasium Sound Systems

1. Provide rack elevation as part of the Construction Document design package.

2. Loudspeakers

a. Elementary School Gymnasiums shall receive a centrally hung loudspeaker with a 360x180 degree (HxV) coverage pattern and a 15-inch bass driver.

b. Middle School and High School Auxiliary Gymnasiums shall receive four directional speakers in a center-hung cluster aimed toward the gym's perimeter.

c. Middle School and High School Competition Gymnasiums shall receive four directional speakers in clusters of two per bleacher side. Each speaker cluster of two shall occupy one channel of a speaker amp. The center cluster will consist of 6 total speakers centrally located with three speakers directed at the audience on each side of the gym. Two of the three speakers per array will handle the mid and high frequency range audio; the central speaker shall be the subwoofer handling the low frequency range.

3. Source Devices

a. Gymnasiums will receive a single-gang Bluetooth wall plate receiver.

b. The Bluetooth wall plate shall have an integrated 3.5mm stereo audio input located on the visible side of the wall plate.

c. Acceptable manufacturers for Bluetooth wall plate receiver shall be AtteroTech by QSC or FBISD Design Manager approved equal.

d. Middle School and Elementary School Gymnasiums will receive three wireless microphone systems.

e. High School Gymnasiums will receive four wireless microphone systems.

f. Each wireless receiver will be furnished with:

i. One (1) wireless handheld dynamic microphone

ii. One (1) bodypack-type transmitter with a lavalier microphone and low-profile ear set microphone.

g. Two wall-mounted antennas will be installed outside the equipment storage closet.

h. When applicable, the Gymnasium shall receive an audio feed from the Cafetorium that will allow it to be used as an overflow seating area.

4. Audio Control System

a. Each gymnasium shall receive a rack-mounted DSP for mixing all sources.

b. Rack-mounted DSP shall be controlled by a wall-mounted single-gang control keypad installed in the gymnasium.

c. Wall-mounted control keypad and Bluetooth wall plate shall be installed within the same electrical box and shall have a locking cover installed over them.

d. Locking cover shall be made of steel and feature a plastic window to see the current status of the control keypad.

e. The acceptable manufacturers for rack-mounted DSPs and wall-mounted single-gang control panels shall be Extron or FBISD Design Manager approved equals.

5. Equipment Storage

a. The amplifier and source devices will be stored in a wall-mounted 19-inch equipment rack.

b. The rack location will require one dedicated 120VAC 20A circuit with one wall-mounted quad receptacle.

c. The equipment rack will typically be located in the gym storage room. Exact placement will vary by project.

6. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

L. Cafetorium/Commons Area Systems

1. Provide rack elevation as part of the Construction Design Package.

2. Loudspeakers and Amplification

a. Cafetorium shall receive one loudspeaker (two total) on either side of the stage's proscenium. In cafeterias with ceilings 15'-0" and lower, the loudspeaker shall be 2-way with 15-inch bass drivers. Cafeterias with 15'-0" or taller or large Cafeteria spaces where it is more suitable for a distributed speaker system provide in-ceiling type speakers.

b. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

c. The wall-mounted loudspeakers in the cafeteria space will be powered by a two-channel amplifier rated for 900 watts per channel @ 8 ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

d. When in-ceiling speakers are used, the amp shall be sized to provide double the continuous power rating for the speaker load on a channel.

e. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

f. When the school design has an operable wall between the Gym and Cafeteria. The system shall be designed as a divisible space. Each system will function independently from the others and be able to handle separate content and sources in the divided condition. In the combined state, the cafeteria system will be the main content source, and the speakers in the gym area will follow the audio from the cafeteria.

3. Audio Source Devices

a. Audio sources will be combined with a mic/line mixer sized appropriately to accommodate the quantity of inputs. The mixer will additionally control the master audio level. A Digital Signal Processor will NOT be used. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Ashley MX508 used in tandem with a Shure SCM 800. Provide lockable cover for Ashley mixer. Install the system once it is programmed and balanced. Turn over cover keys to FBISD IT and FBISD Low Voltage Maintenance department.

b. Provide an audio and mixing board I/O plate at the rear of the Cafetorium space in a location designated by the FBISD Design Manager, FBISD Theater Arts Director, and the AV systems designer. This outlet shall support Theatrical and Production control and input for source content.

c. A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

d. Cafetorium will receive a combination USB/SD/CD player and a Bluetooth receiver. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

e. The Bluetooth receiver will have a long-range antenna that provides consistent signal coverage for the entire Cafetorium.

f. Three wired microphone input plates will be installed in the Cafetorium. One in the middle of the stage steps and one on either side of the stage on the proscenium walls.

g. Each system will receive a rack-mounted wireless microphone system, with a remotely mounted antenna. The antenna location will be at the front of the proscenium wall facing out into the dining area. Elementary Schools will receive two (2) wireless microphone systems. Middle and High Schools will receive twelve (12) wireless microphone systems.

h. Elementary and Middle school campuses shall receive ceiling-suspended choir microphones on the stage. Based on the stage dimensions, the quantity and locations of microphones shall be selected to provide the most even audio coverage possible. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT.

    i. Provide a service loop for the choir mic below the ceiling but out of view of sightlines

i. Acceptable manufacturers:

    i. Shure

    ii. FBISD Design Manager approved equal

j. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is

    i. Antenna Distribution System_ UA844 SWB

    ii. Handheld Wireless System_ SLX-D/ SLX24-

        a. Wireless Receivers_ SLXD4

        b. Wireless Microphone_ SLXD2-SM86

        c. At Elementary School level, provide one Lavalier Microphone and one handheld microphone per receiver

        d. At Middle and High School levels, provide four handheld and twelve lavalier microphones

4. Public Address/Intercom Override

    a. The cafeteria system's audio system will be configured to mute audio during paging events.

    b. Coordination with PA system contractor will be required.

    c. The PA system contractor will provide speaker wire to the paging control relay.

    d. The AV Contractor will be responsible for terminating speaker wire at the paging control relay, and configuring the paging control relay.

    e. The paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

5. Assistive Listening System

    a. An assistive listening system will be installed. The system will consist of a rack-mounted transmitter, a wall or ceiling-mounted RF antenna, and a set of battery-powered receiver units. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Listen L5-055-l72.

    b. The quantity of the receiver units will be determined by the space's occupant capacity.

    c. Provide a shelf within the rack to store ALS receivers and charging apparatus. The shelf will be labeled to indicate this is the space to store ALS equipment.

6. Video Display Devices

    a. A (16:10) motorized projection screen will be installed above the center of the stage behind the proscenium opening, but in front of the curtain. Screen size will be determined by the space served. The screen shall be sized appropriately for BASIC VIEWING / View ratio of 1:6 of the furthest viewing participant from the display surface. Minimum anticipated size is 216" diagonal. If a smaller screen is deemed necessary due to stage restrictions, the consultant shall coordinate size with FBISD Design Manager and FBISD IT.

    b. A 12,000 lumen WUXGA (or better) laser projector will be installed in the dining area centered on the projection screen. The image on the screen shall be a minimum of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Epson Pro L1500UHN.

        i. Provide an appropriate lens for the mounting application.

    c. The projector will be mounted using a motorized projector lift that allows the projector to be serviced from the floor without a ladder. The lift will also accommodate a projected image with NO GEOMETRIC CORRECTION within the projector lens shift capability. The projector and projector lift will require a shared dedicated 120VAC 20A circuit.

    d. Coordinate with FBISD Design Manager and FBISD IT if a fixed pole must be used due to structural, mechanical, or architectural features.

        i. Coordinate the placement of the projector with ANY theatrical lighting in the cafeteria.

    e. Coordinate with FBISD Design Manager and FBISD IT if geometric correction of the projected image is necessary.

    f. The designer shall design the projection system to the space.

g. A 75” Flat panel display will be wall-mounted on either side of the proscenium opening. Each display will require one 120VAC receptacle at the mounting location.

    i. Additional Displays may be necessary when the viewing area is large than the projection screen can adequately serve or if viewing area does not have a direct line of site to the projection screen.

        a. Supplemental display size and height will be coordinated and determined during design with the Architect, FBISD D&C Design Manager, and FBISD IT.

h. Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will be used to house power, data, AV connections, infrastructure, and any associated AV equipment.

7. Flat Panel Display Mounts

    a. The flat panel display mount shall be a low-profile tilting or pole mount rated for the display's size and weight. Wall mount displays will require an articulating arm.

8. Video Sources

    a. The Audiovisual system shall display content from three HDMI input plates located on either side of the stage on the proscenium wall, and at center stage.

    b. An additional HDMI input plate shall be located in the rear of the Cafetorium space in a location designated by the FBISD Design Manager, FBISD Theater Arts Director and the AV systems designer. This outlet shall support Theatrical and Production control and input for source content.

        i. Renovations – if viable conduit and backbox is NOT available for use with center HDMI input, and the renovation scope is NOT adding these in as part of the Work, then it can be omitted from the system design.

    c. The multi-media input plate shall be an HDMI type which transmits video via HDBaseT protocol. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Extron HDMI Plate_ DTP T HWP 4K D Series.

9. Video Switching Devices

    a. A HDMI matrix switcher will be installed in the rack to allow for independent source switching to from all inputs to all outputs. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Extron Switcher_IN1808 Series.

        i. Renovations – If there are NOT existing ancillary displays in the cafeteria other than menu boards and the renovation scope is NOT adding these in as part of the Work, matrix switcher can be omitted from the system design.

10. Equipment Storage

    a. The amplifier and source devices will be stored in a wall mounted, floor-standing26 space 19-inch equipment rack. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Middle Atlantic Rack_CWR-26R.

        i. Provide Shelf for Owner Provided Owner Installed Micro PC.

        ii. Provide Shelf for ADA assisted listening receivers and charging station.

        iii. Provide 3RU rack drawer.

        iv. Provide in rack power strip.

        v. Provide low noise / quiet in rack fans.

        vi. Provide with minimum of 15 spare keys.

    b. The equipment rack will be located on the stage-right wall behind the proscenium.

    c. The rack location will require two wall mounted duplex receptacles, each powered by its own dedicated 120VAC 20A circuit.

11. Audiovisual Control System

    a. The control system will simplify the operator interaction with the Cafetorium Audiovisual system.

    b. The control system will provide basic power up and power down control of the system and control the projector, projection screen and flat panel displays (including digital signage display NOT used with menu board system).

    c. The control system will provide source selection options and audio controls to include microphone level, volume up, down and volume mute.

    d. The control system shall consist of two components, a rack mounted control processor and wall mounted touch screen control panel.

    e. The control panel shall be located on the wall and beside the AV equipment rack on the stage-right wall.

    f. The control panel shall be mounted at 44” above finished floor (AFF) to its vertical center.

    g. Current basis of design is Extron Control Panels EBP 111D.

    h. A lockable cover shall be provided and installed over the control panel. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is FSR WB-PSXG.

        i. Provide a minimum of 5 spare keys with cover.

12. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

M. Band Hall, Orchestra, and Choir Classroom Systems

1. The Band Hall, Orchestra, and Choir projector shall be a wall mounted laser type with a long throw lens. The projector characteristics shall be greater than 7,500 lumen output, a 16:10 native aspect ratio, WXGA or better resolution and be controllable using RS-232. Image at screen shall be a minimum of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR.

2. The projector shall be wall mounted using an arm style mount that allows the projector adequate ventilation on all sides.

    a. Projectors should be mounted at roughly 12’ AFF. Coordinate location and light path with risers and FF&E for height. Tallest expected participant standing on riser to be 7’-0” tall.

3. Design documents shall contain details for lens calculations and relevant sections and elevations showing projector mounting location, light path travel extents, and projection surfaces along with related rough ins for inputs and output devices.

4. Source Interfaces

    a. The projector shall have a minimum of one (2) HDMI inputs and one (1) line level analog audio output. The audio output must de-embed the audio from the selected HDMI input.

5. Typical Placement of Projector in Classrooms

    a. The projector shall be mounted to the wall opposite the common teaching wall.

    b. The projector shall be mounted perpendicular to the center of the projection screen.

    c. The projector shall be mounted at a height that allows the projected image to fill the screen without the use of keystone adjustment.

    d. Projector mounting locations at gypsum walls will receive 3/4" plywood in-wall blocking. Blocking will extend 24” vertically and laterally from the center of the mounting point.

    e. Projectors should be mounted at roughly 12’ AFF. Coordinate location and light path with risers and FF&E for height. Tallest expected participant standing on riser to be 7’-0” tall.

6. Power and AV Pathway Requirements

    a. The projector shall require a single 120VAC quad outlet at the projector mount location.

b. The projector shall require a single wall box at the projector mount location. This box and associated conduit will be used for routing of AV and network cabling from the accessible ceiling space to the projector.

c. An in-wall storage box will be placed adjacent to the projector. This storage box will house the paging override relay.

7. Projection Screen

   a. The projection screen shall be a fixed frame type, with high contrast projection material and a black, light absorbing trim bordering the image area.

   b. The screen size shall be 69 x 110" (130” Diagonal) minimum screen size.

   c. An ambient light rejecting screen is preferred.

   d. The screen shall be mounted directly above the center of the teaching wall marker boards so that the edges of the board and screen touch.

8. Audiovisual Sources

   a. The classroom Audiovisual systems shall display content from Two user work stations. Each user workstation shall receive the following(1) one. wall plate located at the teaching station. The wall plate shall feature:

      i. One (1) HDMI connection

      ii. One (1) Stereo Mini-Jack (3.5mm)

   b. Provide a second input faceplate, custom built audio I/O with (5) Five XLR male and (1) one XLR female connection.

   c. User / Teacher workstation location shall be coordinated with FBISD D&C design manager and FBISD IT

   d. Each classroom shall receive (1) 10’ HDMI Male to Male, gold plated, high retention cable. Cable shall be rated at least 18Gbps (gigabits per second).

9. Audiovisual Control System

   a. The classroom projection system shall be controlled by a wall mounted controller that provides the instructor direct control over power, volume and input sources.

   b. The control functionality shall provide for Projector On/Off, Input 1 (Teacher Wall plate), Input 2 (HDMI 2) and Volume Control Up/Down.

   c. Wall mounted controller shall be located on teaching wall above the multimedia input plate.

   d. The controller shall be mounted at 48” above finished floor (AFF) to its vertical center.

   e. The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.

f. The controller shall communicate via RS-232 between controller and projector.

10. Audio Reinforcement

    a. Band Hall, Orchestra, and Choir Classrooms shall receive one loudspeaker (two total) on either side of the teaching wall and a floor-mounted subwoofer.

    b. The speaker system shall have an on-axis frequency response of 20hz-20khz+/-6db.

    c. The speaker system shall have a maximum SPL rating of 135 dB.

    d. Loudspeakers shall be wall-mounted, using mounts that allow precise aiming.

    e. The loudspeakers will be powered by a four-channel amplifier rated for at least 1000 watts per channel, @ 8 ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

11. Audio System Storage

    a. Band Hall, Orchestra, and Choir Classrooms shall receive a rolling equipment rack.

    b. The equipment rack will have 12RU on the sides and a 10RU “pop-up” mixer rack on the top.

    c. The rack shall house the mixer, amplifier, playback/recording devices, and other audio equipment.

12. Audio Mixer

    a. Audio sources will be combined with a sixteen-input/channel mic/line mixer. The mixer will additionally control the master audio level and provide signal routing to/from the playback and record decks.

        i. Mixer channels shall be machine labeled.

13. Audio Source Devices

    a. A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

    b. Band Hall and Choir Classrooms shall receive a combination USB/SD/CD/Bluetooth player and media recorder.

14. Wired Microphones

    a. Each classroom will receive 4 ceiling-mounted “choir type” hanging microphones.

        i. Ensure microphones are installed and coordinated with the owner provided risers

ii. Ensure microphones are installed so as not to obstruct the projector light path.

iii. Provide a service loop for the choir mic below the ceiling but out of sightlines

15. Wireless Microphones

a. Choir Classrooms shall receive four wireless microphone systems.

b. Each wireless receiver shall be furnished with one (1) wireless handheld dynamic microphone.

c. Antennas shall be mounted in the equipment rack.

16. Audio Connector Plate

a. Each classroom will receive a 3-gang custom connector plate connecting the audio rack to various components around the room.

b. The plate will be black anodized aluminum with white engraved labels for each connector.

c. Connectors will include:

i. One (1) Neutrik NL4 connector for the loudspeaker connection.

ii. One (1) Neutrik NL2 connector for the paging relay connection.

iii. Two (2) Neutrik XLR male connectors for projector audio.

iv. Four (4) Neutrik XLR male connectors for microphones.

17. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

N. Theater Classroom Systems

1. Video Display System

a. The video portion of the Theater Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section 27 41 00 | 1.11. B Classroom Audiovisual Systems.

2. Audiovisual Control System

a. The classroom audio system shall be controlled by a wall-mounted controller that provides the instructor with direct control over power, volume, and input sources.

b. The control functionality shall provide for Audio system ON/OFF and Volume Control Up/Down.

c. The wall-mounted controller shall be located on the teaching wall above the multimedia input plate.

d. The controller shall be mounted at 48” above finished floor (AFF) to its vertical center.

e. The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.

f. The controller shall communicate via RS-232 between the controller and the projector.

3. Audio Reinforcement

   a. Theater Classrooms shall receive one loudspeaker (two total) on either side of the teaching wall. The loudspeakers shall be 2-way with 12-inch bass drivers.

   b. Loudspeakers shall be wall-mounted, using mounts that allow precise aiming.

   c. The loudspeaker will be powered by a two-channel amplifier that is rated for 500 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

4. Audio System Storage

   a. Theater classrooms shall receive a rolling equipment rack.

   b. The equipment rack will have 12RU on the sides and a 10RU “pop-up” mixer rack on the top.

   c. The rack shall house the mixer, amplifier, playback/recording devices and other audio equipment.

5. Audio Mixer

   a. Audio sources will be combined with a sixteen-input/channel mic/line mixer. The mixer will additionally control the master audio level and provide signal routing to/from the playback and record decks.

6. Audio Source Devices

   a. A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

   b. Band Hall and Choir Classrooms will receive a combination USB/SD/CD/Bluetooth player.

7. Audio Connector Plate

   a. Each classroom will receive a 4-gang custom connector plate connecting the audio rack to various components around the room.

   b. The plate will be black anodized aluminum with white engraved labels for each connector.

   c. Connectors will include:

i. One (1) Neutrik NL4 connector for the loudspeaker connection.

ii. One (1) Neutrik NL2 connector for the paging relay connection.

iii. Two (2) Neutrik XLR male connectors for display audio.

8. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

O. Dance Classroom Systems

1. Video Display System

a. The video portion of the Dance Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section 27 41 00 | 1.11. B Classroom Audiovisual Systems.

2. Audiovisual Control System

a. The dance classroom audio system shall be controlled by a wall-mounted controller that provides the instructor with direct control over power, volume, and input sources.

b. The control functionality shall provide for the audio system On/Off and Volume Control Up/Down.

c. The wall-mounted controller shall be located on the teaching wall above the multimedia input plate.

d. The controller shall be mounted at 48” above finished floor (AFF) to its vertical center.

e. The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.

f. The controller shall communicate via RS-232 between the controller and the projector.

3. Audio Reinforcement

a. Dance Classrooms shall receive one loudspeaker (four total) in each corner of the room. The loudspeakers shall be 2-way with 12-inch bass drivers.

b. Loudspeakers shall be wall-mounted, using mounts that allow precise aiming.

c. The loudspeaker will be powered by a four-channel amplifier rated for 500 watts per channel, @ 8 ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

4. Audio System Storage

a. Dance classrooms shall receive a rolling equipment rack

5. Audio Source Devices

a. A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

b. Bluetooth Audio input from anywhere in the room.

6. Audio Connector Plate

a. The plate will be black anodized aluminum with white engraved labels for each connector.

i. Connectors will include one (1) 3.5mm audio input

7. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

P. Black Box Theater Systems

1. Video Display System

a. The video portion of the Black Box Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section 27 41 00 | 1.11. B Classroom Audiovisual Systems.

2. Video Sources

a. The Audiovisual system shall extract audio content from four HDMI and 3.5mm input plates, one on each wall.

b. Audio source content can also be distributed through a Bluetooth connection to the user device anywhere in the room.

c. Additional audio content will be played on an Owner-provided Mac Mini computer. This computer will be housed in the equipment rack.

3. Loudspeakers and Amplification

a. The Black Box Theater shall receive four loudspeakers in each corner of the lighting grid facing into the center of the room. The loudspeakers shall be 2-way with 12 or 15-inch bass drivers.

b. The speaker system shall have an on-axis frequency response of 20hz-20khz+/-6db.

c. The loudspeaker will be powered by a four-channel amplifier rated for 900 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

d. Each speaker cable from the amplifier/rack location will be terminated into a Neutrik NL4 connector mounted to a plate/box attached to the lighting grid. A premade eight-foot jacketed NL4 speaker cable will connect the connector plate to the loudspeaker.

4. Audio Mixer

a. Audio sources will be combined with a digital, sixteen-input/channel mixing board. The mixer will additionally control the master audio level and provide for signal routing to/from the playback deck and assistive listening system.

b. The mixer will be mounted into the top rack on the rolling rack.

5. Audio Source Devices

   a. The Black Box Theater will receive a combination USB/SD/CD/Bluetooth player.

6. Microphone Inputs

   a. Four (4) suspended choir microphones will be centered in the performance space. Provide a service loop below the ceiling but close to the lighting structure.

   b. The plate will be black anodized aluminum with white engraved labels for each connector.

7. Wireless Microphones

   a. The Black Box Theater will share a rack-mounted wireless microphone system within a mobile rolling rack. The wireless microphone system will be shared between the Auditorium/stage and the black box classroom.

   b. Each wireless receiver will be furnished with:

      i. One (1) wireless handheld dynamic microphone

      ii. One (1) bodypack type transmitter with a lavalier microphone and low-profile earset microphone.

   c. C. Two paddle-type antennas will be mounted at 120” AFF on either side of the theater.

8. Assistive Listening System

   a. An assistive listening system will be installed. The system will consist of a rack-mounted transmitter, a wall or ceiling-mounted RF antenna, and a set of battery-powered receiver units.

   b. The occupant capacity of the space will determine the quantity of the receiver units.

   c. Provide a shelf within the rack to store ALS receivers and charging apparatus. The shelf will be labeled to indicate this is the space to store ALS equipment.

9. Main Audio Connector Plates

   a. A 2-gang custom connector plate will connect the audio rack to the loudspeakers in the space.

   b. The plate will be black anodized aluminum with white engraved labels for each connector.

c. Connectors will include one (1) Neutrik NL4 connector for the loudspeaker connection.

d. A 4-gang custom connector plate will connect the audio rack to the microphone connections in the space.

    i. The plate will be black anodized aluminum with white engraved labels for each connector.

e. A 2-gang custom connector plate will connect the audio rack to the RF antennas in the space.

    i. The plate will be black anodized aluminum with white engraved labels for each connector.

f. Connectors will include:

    i. Two (2) Neutrik 50 Ohm BNC coupling connections for the wireless microphone antennas.

    ii. One (1) Neutrik 50 Ohm BNC coupling connection for the assistive listening system antenna.

10. Public Address/Intercom Override

11. Equipment Storage

    a. The Black Box Theater will receive a rolling equipment rack.

    b. The equipment rack will have 12RU on the sides and a 10RU “pop-up” mixer rack on the top.

    c. The rack shall house the mixer, amplifier, wireless microphone system, playback devices and other audio equipment.

12. Performance / Backstage Intercom System

    a. Provide a wireless performance intercom system to be shared between the black box and Auditorium.

        i. The system will have 10 user packs.

        ii. A rolling rack shall be provided to house the equipment.

        iii. Approved manufacturers:

        iv. Clear Comm

        v. FBISD approved equal

13. Shared Wireless Microphone System

    a. MS system shall have 12 wireless microphones

        i. Coordinate quantity of lapel and handheld units with FBISD D&C Design Manager, FBISD Theater Arts, and FBISD IT departments.

    b. HS system shall have 16 wireless microphones

i. Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments.

14. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

Q. High School Auditorium Systems

1. Main Projection System

a. A 283-inch diagonal (16:10) motorized projection screen will be mounted behind the front edge of the proscenium, in front of the main curtain.

i. Coordinate the location of the projection screen with the stage and theatrical lighting. Stage and Theatrical lighting take precedence over the AV display, and the display location will adjust around the lighting.

ii. In Renovations, attempt to meet the new building design. Screen location will adjust around the lighting

b. The screen shall be furnished with enough additional black material so that it can be lowered to the stage floor.

c. A 16,000 lumen (or better) WUXGA laser projector will be mounted centered laterally on the projection screen in an area that is accessible from the catwalk.

d. Image at screen shall be a minimum of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR.

2. Video Switching

a. A modular 16x16 (input x output) video switcher will be installed in the stage rack. It will allow for switching and scaling between multiple input sources. Additionally, it will de-embed analog audio from video signals for playback through the sound system.

3. Video Sources

a. The Audiovisual system shall display content from six (6) HDMI input plates.

i. One (1) plate (two total) shall be located on the rear side of the proscenium walls on both sides of the opening.

ii. One (1) plate shall be located in the front/center stage pocket.

iii. One (1) plate shall be located at the on-stage equipment rack location.

iv. Two (2) plates shall be located at the control booth.

v. HDMI patch cables shall be provided for each input plate. Reference paragraph 1.17.15 for cable requirements.

b. The multi-media input plates shall be an HDMI type which transmits video via HDBaseT protocol.

c. Video content shall be played on an Owner-provided Computer housed in the control booth.

d. Video content shall be played on a computer provided by the owner, which will be housed in the control booth.

e. Video input source faceplates, lighting control, and AV control shall be provided at both the “house” booth and sound booth locations.

4. Auxiliary Projector

   a. One (1) 8,000 lumen laser (or better) WUXGA projector shall be turned over to the Owner at system commissioning. This projector will be used to project onto the cyclorama and for other theatrical effects. The projector shall be equipped with an ultra-short-throw lens.

      i. Shall have at least one HDMI input

      ii. Optional USB-C

5. Main Loudspeakers and Amplification

   a. An acoustic engineer shall design the audio system and acoustic features of the space.

   b. Lighting take precedence in terms of location. Adjust the speaker array and location as needed.

   c. The Auditorium shall receive a hanging line array speaker clusters arranged/wired in an LCR (left, center, right) configuration. Center Cluster is optional and desired if it does not affect lighting. Line array clusters shall be located to the left and right of the proscenium opening, with a smaller cluster located above the lateral center of the proscenium opening.

   d. Besides the main full-range line array cabinets, the left and right clusters shall feature a subwoofer cabinet.

      i. Speakers shall be arranged to provide a full spectrum of evenly distributed sound from 20Hz to 20KHz. Provide supplemental speakers as needed to broadcast sound evenly.

      ii. Stage and Theatrical Lighting take precedence over speaker location. Adjust the speaker design to accommodate lighting.

   e. A licensed structural engineer must approve all rigging/structural design and calculations. A licensed rigging contractor must carry out all rigging work.

   f. The loudspeaker system shall be amplified in a way to meet the following requirements:

      i. All full-range cabinets shall be bi-amplified.

      ii. The discreet LCR characteristic of the sound system shall be preserved. Amplifier channels shall not be split across clusters.

      iii. Each subwoofer shall receive a discrete amplifier channel.

iv. Each amplifier channel's power rating shall be twice the combined RMS rating of all connected loads.

g. Amplifiers shall be located in the on-stage rack.

6. Stage Monitor loudspeakers

a. Six (6) self-amplified monitor speakers shall be provided for audio monitoring on stage. The loudspeakers shall be 2-way with 12-inch bass drivers. Internal amplifier power shall be rated at least 1000 Watts.

b. Three of the six speakers are to be rear-facing at the proscenium. The location shall be coordinated and determined by the lighting layout.

c. The three remaining speakers shall be mobile and plug into the floor boxes.

i. Renovations. If floor boxes are not available, provide a faceplate for connection at stage right and left. Downstage, coordinate location with the FBISD D&C Design Manager, FBISD Theater, and FBISD IT departments.

d. The monitors shall receive audio signals from the digital snake head through XLR connectors in the recessed stage pocket boxes. Reference section below.

7. Digital Audio Console and Stage-Box

a. Audio sources will be combined and routed with a digital audio console. The console will provide signal routing level control to the LCR main speakers and stage monitors.

b. The digital audio console shall have 32 on-board microphone inputs and be capable of 80 mix channels, with the addition of the digital stage box.

c. The Digital Audio Console shall be located in the control booth.

d. A 32-channel digital audio stage box shall be located in the on-stage rack. Machine label each channel.

8. Audio Source Devices

a. The Auditorium control booth will receive a combination USB/SD/CD/Bluetooth player.

9. Wireless Microphones

a. Sixteen (16) wireless microphone receivers shall be located in the MOBILE equipment rack, which will be shared with Black Box Classrooms.

b. Each wireless receiver shall be furnished with:

i. One (1) wireless handheld dynamic microphone

ii. One (1) bodypack type transmitter with both a lavalier microphone and a low-profile earset microphone.

c. MS system shall have 12 wireless microphones

   i. Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments.

d. HS system shall have 16 wireless microphones

   i. Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments.

e. Two wall mounted paddle type antennas will be wall mounted at 120” AFF on either side of the stage.

10. Wired Microphones and Accessories

    a. The following microphones shall be turned over to the Owner at system commissioning.

       i. Four (4) hanging mini-condenser cardioid microphones.

       ii. Four (4) handheld cardioid dynamic vocal microphones.

       iii. Two (2) super-cardioid dynamic instrument microphones.

       iv. One (1) dynamic kick drum microphone.

       v. Four (4) Small-diaphragm Mini Cardioid Condenser Microphone with 84" Carbon Fiber Boom Arm.

    b. Each microphone shall be provided with 25-foot black microphone cables with Neutrik connectors. An additional twenty (20) cables shall be turned over for future expansion.

    c. The following microphone stands shall be turned over to the Owner at system commissioning.

       i. Eight (8) black, round base, full height microphone stands.

       ii. Four (4) tripod/boom adjustable height 36"-64" microphone stands.

       iii. Five (5) black 9 inch-12 inch round base microphone stands.

11. Suspended Microphone Inputs

    a. Four (4) XLRF input boxes, evenly spaced above the center of the stage, shall be installed to facilitate the use of hanging microphones.

    b. A microphone input connector plate will be located on each of the four walls of the Auditorium. A 2-gang box and plate will be mounted at 18” AFF centered on each wall. Each plate will contain three panel mount Neutrik XLR female connectors.

    c. The plate will be black anodized aluminum with white engraved labels for each connector.

12. Assistive Listening System

a. An assistive listening system will be installed. The system will consist of a rack-mounted transmitter, a wall or ceiling-mounted RF antenna, and a set of battery-powered receiver units.

b. The quantity of the receiver units will be determined by the occupant capacity of the space.

13. Audiovisual Control System

    a. The control system will simplify the operator's interaction with the Auditorium Audiovisual system.

    b. The control system will provide basic power-up and power-down control of the system and will control the projector, projection screen, and flat-panel displays.

    c. The control system will provide source selection options and audio controls including microphone level, volume up, down and volume mute.

    d. The control system shall consist of three components: a rack-mounted control processor and two (2) wall-mounted touch-screen control panels.

    e. The control panels shall be located at the on-stage rack and in the control booth.

    f. The control panel shall be mounted to its vertical center at 44” above the finished floor (AFF).

14. Equipment Racks

    a. Equipment racks shall be located in the AV/Lighting Control Booth and on stage.

    b. Provide a dedicated drawer for storing Mic and Mic Accessories.

    c. Provide a shelf for the ALS system.

    d. Equipment racks shall be floor-standing and feature active ventilation systems, power sequencing, and locking front security doors.

    e. The on-stage rack(s) shall be located on the right side of the stage (audience perspective).

    f. The stage rack location shall receive a minimum of 4 dedicated 120VAC 20 Amp circuits.

    g. The AV/Lighting Control Booth rack shall receive a minimum of 2 dedicated x 120VAC 20 Amp circuits.

15. Stage Floor Box Connections

    a. Renovations: If there are no existing floor boxes or viable conduits and backboxes are NOT available for use with a floor box, and the renovation scope does not include these as part of the Work, then it can be omitted from the system design.

b. Six (6) recessed stage boxes shall be installed on the stage. The boxes will be arranged in two lines, with three upstage and three downstage.

c. The plate shall be black anodized aluminum with white engraved labels for each connector.

d. Each floor box shall be equipped with the following connectors:

i. Four (4) Neutrik XLR Female connectors for microphones and other audio.

ii. One (1) Neutrik XLR Male connector for monitor loudspeakers.

iii. One (1) Neutrik Ethercon Connector for a HDBaseT video.

a. Contractor shall turn over HDBT TX and RX equipment to FBISD IT

iv. One (1) Ethernet network connection. Reference division 27 15 00 specifications.

v. One (1) duplex 120VAC power receptacle on a dedicated 20A circuit.

e. Acceptable manufacturers:

i. Ace Backstage

ii. Or FBISD approved equal

16. Lobby Video Feed

a. The Auditorium Lobby shall receive audio and video feeds from the auditorium to use the lobby as an overflow viewing area.

b. A 65-inch flat panel display shall be mounted centered on the wall closest to the auditorium. The display shall receive an HDBaseT feed from the video switcher and be capable of being utilized as a digital signage display.

c. Digital signage players shall be Owner-Furnished Owner-Installed (OFOI).

d. A fixed video camera shall be installed at the control booth location to capture the stage performance for viewing in the lobby.

e. A fixed video camera shall be placed on the ceiling backstage to provide a bird 's-eye view of the stage. The camera shall have infrared capabilities.

17. Dressing Room Feed

a. Audio and video programs from the auditorium shall be made available in the dressing rooms.

i. Displays in these locations are controlled locally.

18. Performance / Backstage Intercom System

a. Provide a wireless performance intercom system to be shared between the black box and Auditorium.

i. The system will have 10 user packs.

ii. A rolling rack shall be provided to house the equipment.

iii. Acceptable Manufacturers:

a. Clear Comm

b. FBISD

c. approved equal.

19. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

R. Weight Room Sound Systems

1. Provide rack elevation as part of Construction Document design package.

2. Loudspeakers and Amplification

a. Weight Rooms shall receive six (6) in-ceiling loudspeakers with a 1-inch compression driver and a 6.5-inch bass driver. Loudspeakers shall have an integrated 70/100-volt transformer and be rated for a minimum of 150-atts.

b. The loudspeaker will be powered by a two-channel amplifier rated for 300 watts per channel @ 8 ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

3. Source Devices

a. Weight Rooms will receive a single-gang Bluetooth wall plate receiver.

b. The Bluetooth wall plate shall have an integrated 3.5mm stereo audio input located on the visible side of the wall plate.

4. Audio Control System

a. Each Weight Room shall receive a rack-mounted DSP for mixing of all sources.

b. The rack-mounted DSP shall be controlled by a wall-mounted single-gang control keypad installed in the Weight Room.

c. The wall-mounted control keypad and Bluetooth wall plate shall be installed within the same electrical box.

5. Equipment Storage

a. The amplifier and source devices will be stored in a wall-mounted 19-inch equipment rack.

b. The rack location will require one dedicated 120VAC 20A circuit with one wall-mounted quad receptacle.

c. The equipment rack will typically be located in an adjacent storage room, but the exact placement will vary by project.

6. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

Part 2 - Products

2.01 Additional Specified Products

A. Many AV products are specified on the technology drawings and not necessarily listed in this specification. AV products shown in the drawings shall be considered part of this specification regardless of whether they are listed below.

B. If a specific product manufacturer and/or model is indicated on the drawings and other manufacturers are listed in this specification, the product shown on the drawings shall be the basis of design. Equal products by the other listed manufacturers may be considered via the substitution process outlined in 27 00 00.

C. AV products specified in the drawings typically appear on the AV detail sheets, either in a schematic line drawing, a loose equipment list, or a schedule (ex, speakers, displays, etc.).

D. Not all AV products appear on the drawings. Products listed in this specification but not shown on the drawings are still required as part of a comprehensive AV bid package.

2.02 Assistive Listening Systems

A. Assistive listening systems shall include a stationary transmitter (and antenna distribution if needed) with receivers, earphones, neck loops, and signage.

B. Provide all components necessary to meet the space's ADA / IBC and local code requirements. Quantity of receivers, earphones, and neck loops shall be calculated to meet ADA / IBC formulas.

C. In addition to ADA-required components, provide locking carrying cases with charging bases and rechargeable batteries to match the number of receivers.

D. Technology:

1. IR – Provide infrared system in smaller spaces where information being shared is secret or confidential and in buildings where there are many such systems and not enough RF spectrum for the channel count.

2. RF – Provide radio frequency system (72 MHz or 216 MHz) in locations where a large coverage area is needed, and information being shared is not expected to be secret or confidential.

3. Wi-Fi – Provide a Wi-Fi/network system as a secondary solution in all spaces with assistive listening

4. Loop – Provide an underfloor hearing loop where required by local code and/or indicated in the system description or design details

E. Manufacturers:

1. Listen Technologies
2. Or FBISD approved equal

2.03 Audio Amplifiers

A. Amplifiers shall be sized to match the speaker manufacturer's recommended amplifier power plus 20% additional headroom

B. Refer to technology drawing details for specific product information.

C. Manufacturers

1. Library
    a. Stuart Audio CVA 25 x 1 70v/100v or current equivalent (library system).
2. Gymnasiums
    a. Elementary school
        i. Crown CDi DriveCore 2|300
        ii. Alternates:
            a. QSC
            b. Crown
            c. Or FBISD approved equal
    b. Middle and High school
        i. Crown CDi DriveCore 4|1200
        ii. Alternates:
            a. QSC
            b. Crown
            c. Or FBISD approved equal
3. Cafeteria
    a. Crown CDi DriveCore 2|1200
    b. Alternate:
        a. QSC
        b. Crown
        c. Or FBISD approved equal
4. Band Hall, Orchestra, Choir, Theater, Dance, Weight, and Black Box classrooms

a. Crown

b. QSC

c. FBISD approved equal

d. Powered speakers may be used as an alternative for dance classrooms.

5. Auditorium

a. Crown

b. Or FBISD approved equal

2.04 Audio Mixing Console

A. Manufacturers:

1. Gymnasiums, Weight, and Dance classrooms

a. Extron

2. Cafeteria

a. Ashley MX508 used in tandem with a Shure SCM800

b. Or FBISD approved equal

3. Band hall, Orchestra, Choir, and Theater classrooms

a. SoudCraft

b. Allen & Heath

c. Or FBISD approved equal

4. Black Box classroom

a. Soundcraft

b. Or FBISD approved equal

5. Auditorium

a. Yamaha

b. Or FBISD approved equal

2.05 Audio Recorder

A. Manufacturer: Denon DN-700R

2.06 AV Network Switches

A. Provide network switches for AV systems as necessary.

B. Switches shall be sized to match the number of connections and PoE/PoE+ load.

C. For AV systems where the AV manufacturer publishes a list of recommended or approved switches, the network switches must be on this list. For AV systems where the AV manufacturer does not publish a list, the network switches must meet the minimum specifications required by the AV equipment and recommended by the manufacturers.

D. Manufacturer: FBISD approved

2.07 AV-Over-IP System

A. Provide models as required by location/function

B. Manufacturers:

1. Hall research
2. Extron
3. Or FBISD approved equal

2.08 Bluetooth Extender Plates

A. Single-gang, Decora style in-wall Bluetooth audio interface

B. One button pairing/connect with LED indicator

C. Serial control protocol for integration with control system

D. Defeatable pairing button for restricted use applications with control system

E. Balanced mono/stereo analog outputs

F. Compatible with smartphones, Apple iPads, and Android tablets

G. Manufacturer:

1. Attero Tech by QSC
2. Or FBISD approved equal

2.09 Cable

A. Cable shall be provided and installed as detailed herein. Cable installed that does not conform to these standards or that has not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. All AV cabling shall be black.

C. Plenum: Plenum-rated cables shall be used where required by code or by best practices. All cables run beneath raised floor shall be plenum-rated.

D. High-Definition Digital Video (HDMI)

1. Due to HDMI distance limitations, anywhere the cable distance exceeds 20 feet, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables exceed 20 feet regardless of whether they are explicitly shown or specified. At locations where the end-to-end cable distance is 20 feet or less, commercial-grade passive HDMI cables may be used. Provide a cable channel that is reliable and functions with all source devices the Owner may use.
2. Acceptable solution shall support HDMI 2.0a and 4K@60Hz 4:4:4 at minimum.
3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.
4. Manufacturers:
    a. Middle Atlantic
    b. Comprehensive
    c. Or FBISD Design Manager approved equal

E. USB

1. Due to USB distance limitations, anywhere the cable is routed within the wall or above the ceiling, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables route through walls or ceilings regardless of whether they are explicitly shown or specified.
2. Acceptable solution shall support at a minimum USB 2.0 except where noted otherwise.
3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.
4. Manufacturers:
    a. Atlona
    b. Broadata
    c. Crestron
    d. Extron
    e. Liberty AV

F. Where AV over IP is necessary provide CAT6A cable for connectivity.

1. Manufacturers:
    a. Liberty
    b. Middle Atlantic
    c. Or FBISD approved equal

G. Installed Video: Video signal coaxial cables shall have #18 solid copper center conductor, gas-injected high density Polyethylene or Fluorinated Ethylene Propylene insulation, copper braid shield of at least 95% coverage and 100% dual-sided foil and black PVC jacket unless color is otherwise noted. Cable shall be designed as a low loss serial digital video cable. Belden 1694A, WestPenn 6350, Canare L-5CFB, Liberty 18-CMR-SD, or equal. Plenum cable, Belden 1695A, WestPenn 256350, Liberty 18-CMP-VID-COAX, or equal.

H. Flexible Video: Short video cables that are intended to be moved or adjusted on a regular, frequent basis may be constructed of a stranded bare copper center conductor RG-59/equivalent cable with >94% copper braid shield and polyethylene dielectric. Canare LV-61S, Belden 1505A, WestPenn 819, or equal. Plenum cable, Belden 1506A, WestPenn 25819, or equal.

I. High Resolution RGBHV Graphics/Video: Cable type and size shall be selected to provide a minimum of 250 MHz bandwidth (-3dB) at over the length of each RGBHV signal path from source to display, including losses and gains through cable loss, signal processing, switching and distribution equipment. Manufacturer shall designate cable as suitable for high-resolution use. Extron MHR-5, Liberty RGB5C-25-CM or equal. Plenum cable, Extron MHR-5P, Liberty RGB5C-25-CMP, or equal.

J. Installed Line Level and Microphone (single line): Audio signal cable shall have twisted pair #22 stranded tinned copper conductors, polyethylene conductor insulation, aluminum-polyester foil shield, #24 stranded tinned copper drain wire, and chrome PVC jacket.

    1. Acceptable manufacturers:

        a. Middle Atlantic

        b. Comprehensive

        c. Or FBISD Design Manager approved equal

K. Portable Microphone, Enclosure and Breakout Line Level Audio: Cable shall have 4 conductors per channel arranged in star quad double-balanced pairing, #24 stranded conductors of at least 40 tinned annealed copper wires, 100% coverage wrap shield, tinned copper braid shield of approximately 50% coverage, uniformly round form and black PVC jacket. Canare L-4E6S, Belden 8723, WestPenn 355, or equal. Plenum Cable, Belden 88723, Liberty 24-4P-PLCSH-WHT, or equal.

L. Broadband Video Antenna Cable: For runs shorter than 15', RG-59. For runs 15'-50', RG-6.

M. Wireless Microphone Antenna Extension Cable: 50-Ohm coaxial cable, or as directed by microphone manufacturer.

N. Loudspeaker Wire: 14 AWG minimum.

O. Subwoofer Wire: 10 AWG minimum.

P. UTP Cable: Shall be consistent with specific recommendations by hardware manufacturer of transmission equipment. Where no clear recommendation is made, the cable shall at a minimum meet the Category 6 performance requirements outlined in 27 15 00.

Q. Control: Shall be as recommended by equipment manufacturer, with the appropriate number of conductors for the application.

R. Cable Construction: Contractor shall fabricate interconnecting cables using products defined in this section unless equipment manufacturer-provided cable is of a specialized or proprietary nature. Pre-manufactured cables are subject to prior approval by Consultant.

S. Labels: Labels shall include a white paper or vinyl slip with typed or machine printed designations, secured in place with a wider section of clear heat shrink tubing or integral clear adhesive-backed plastic.

T. Terminations: Provide specialized terminating hardware as required.

U. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating cable types that will be used on the project

2.10 Camera Systems

A. Pan/Tilt/Zoom (PTZ) Cameras

1. Wide-angle PTZ camera, at least 60-degree horizontal field of view, with 1080p/60Hz resolution

2. Ethernet network solution with ability to integrate multiple cameras and Dante audio in a single system

3. USB user interface with Dante audio to bring camera video and separate Dante microphone audio into a computer over a single USB cable for distance learning, recording, and conferencing applications.

4. Confirm exact camera locations and intended views with Consultant and Owner prior to installation.

5. Acceptable manufacturers:

a. Sony

b. Panasonic

c. Or FBISD approved equal

2.11 Ceiling Enclosure Box

A. Certain locations noted on plans shall receive a large flush-mount ceiling box that replaces a 2’x2’ ceiling tile. This box shall function as a centralized location for display connectivity (data, power, AV) as well as a space to house any electronics feeding or controlling the display.

B. The ceiling box shall include knockouts where single-gang boxes can be attached on at least three sides.

C. Contractor shall be responsible for proposing an enclosure that accommodates all anticipated equipment and includes sufficient passive or active ventilation for the heat load generated.

D. Manufacturers: Chief, FSR, Legrand Wiremold, Premier Mounts, or approved equal

1. FSR CB-224S – provide at any location where a single component is greater than 1 RU or where the sum of the components is greater than 2 RU

2.12 Conferencing System

A. All-in-one soundbar

1. Conferencing soundbar with speaker, camera, and microphone in a single enclosure and one USB connector.

2. Single USB 3.0 interface

3. Built-in 180-degree far field microphone array

4. Built-in intelligent 1080p video camera with digital autozoom and autoframing

5. High powered 2-way stereo speakers

6. Manufacturer:

a. Biamp

b. Bose

c. Crestron UC-SB1-CAM

d. Yamaha

e. Or FBISD approved equal

B. Conference room kit

1. Manufacturer:

a. Logitech Rally & Rally Plus kit solutions

2.13 Connectors

A. Connectors shall be provided and installed as detailed herein. Connectors installed that do not conform to these standards or that have not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. HDMI (Video/Audio/Control): Cables to be factory-terminated with molded strain relief.

C. BNC (Video): Video signal BNC connectors shall be 3-piece crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. Canare BCP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

D. RCA (Video): Video signal RCA connectors shall be 3-piece crimp-on type with gold flashed center pin, Canare RCAP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

E. F (Video): Video signal F connectors shall be 3-piece crimp-on type with gold flashed crimp-on center pin. Canare FP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

F. BNC (RGBHV Graphics): Graphics signal BNC connector shall be crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. BNC manufacturer, model and tools as recommended by the manufacturer of the RGBHV/graphics cable.

G. XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Neutrik CA-NC series or equal.

H. Mini-XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Switchcraft or equivalent.

I. Phono (RCA): Phono/RCA connectors shall have gold contact and solid center pin with metal strain relief. Canare F-10 or Canare F-09 or equal.

J. Phone (1/4 inch): Reinforced one-piece body shall have brass bar running length of handle. Canare F-15 (TS) or Canare F-16 (TRS) or equal.

K. Mini (1/8 inch): Shall be Canare F-11 (TS) or Canare F-12 (TRS) or equal.

L. RJ45: RJ45 jacks that are field-terminated shall be punch-down type. All flexible connectivity to AV devices shall be factory-molded patch cables. Where a field-terminated plug is required by manufacturer recommendations, Contractor shall use appropriate connector type to the type of cable used (solid vs. stranded).

M. Shielded cable to be terminated with shielded connectors or as required by manufacturer recommendations.

N. DM, DM8G+: Shall be Crestron shielded RJ-45 and fiber connectors, as recommended by manufacturer of DM or DM8G+ system.

O. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating connectors that will be used on the project.

2.14 Control Room Furniture

A. Contractor shall coordinate work surface finishes with Architect to match facility aesthetics

B. Control desk to include:

1. Built-in rack space for AV headend and production equipment

2. Work surface layout to support: camera controller, video production control panel, AV touch panel, push-to-talk microphone, keyboard/mouse for video production, and keyboard/mouse for PC/Mac

3. Integrated video monitor mounts

4. Integrated audio/studio monitor mounts

5. Concealed cable pathways

C. Manufacturer:

1. Forecast Consoles

2.15 Control Systems

A. Control system processor with ability to control all major system components and functions within a given room, including items such as: flat panel displays, media players, projectors, projection screens, presentation switcher, digital mixer, digital signal processor (DSP), power sequencers, etc.

B. Control system may be built into a presentation switcher, DSP, or standalone

C. Each control system shall include a control interface. In large venue or complex spaces, this shall be a touch panel controller – 7” or 10” minimum diagonal size depending on requirements. In smaller spaces and simpler systems, this could be a smaller touch panel, keypad, or button panel.

D. Control systems shall be network manageable. Contractor shall set up manufacturer’s network interface for Owner to use.

E. Manufacturers:

1. Extron MLC 64 RS VC D (library)

2. Or FBISD approved equal

2.16 Digital Signage System

A. Provide digital signage players at displays where noted on the plans. For all such displays, include a full-feature signage license

B. Signage Player Manufacturer:

1. BrightSign XT1144

2. or FBISD approved equal

C. Software Manufacturer:

1. Carousel

2.17 Digital Signal Processor

A. Minimum 4 input, 4 output audio DSP. Provide larger model and/or additional expansion I/O modules as necessary to support the number of connections in a given system.

B. Supports Acoustic Echo Cancellation on microphone inputs

C. RS-232 and/or Ethernet control to interface with AV control system.

D. Dante support where applicable

E. Manufacturers: Allen & Heath, Biamp, Extron, QSC, or Symetrix

2.18 Document Camera

A. Manufacturer:

1. Epson DC-21

2.19 Equipment Racks

A. Sized to fit all system equipment with space for airflow and future expansion

B. Casework/millwork locations

1. Sized to fit all system equipment with space for airflow and future expansion

2. Coordinated to fit inside of casework; refer to architectural plans

a. Fan kit with thermostatic fan control

b. Coordinate active cooling and ventilation with millwork contractor

c. Ventilation shall include passive air intake at the bottom and exhaust at the top

3. Manufacturers:

a. Middle Atlantic

b. Liberty

c. Gator (Band Hall, Orchestra, Choir, Theater, Dance and Blackbox)

d. SKB (Band Hall, Orchestra, Choir, Theater, Dance and Blackbox)

e. Or FBISD approved equal

C. Instructor lectern locations

1. Rack shall be built into the lectern.
2. All finishes shall be coordinated with Owner. An approved proof of concept is required prior to ordering.
3. AV Contractor shall coordinate with Architect and furniture provider to ensure the appropriate rack space and cable pathways are provided.

D. Fixed wall locations

1. Provide with:
    a. 1 RU vented blank panels between all major components (e.g. amplifiers) and equipment groupings (e.g. wireless receivers, media players, etc.)
    b. 4 RU rack drawer for housing microphones and cables
    c. Locking vented front door
    d. Quiet fan kit with thermostatic fan control
2. Manufacturers: Middle Atlantic SR-Series or equal

2.20 Equipment Rack Header Panel

A. Header panel shall be laser-etched with white print and shall include Consultant logo and website as well as Contractor's logo and website information.

B. Header panel shall include service port if applicable. Otherwise provide with port cover.

C. Manufacturer: RCI Custom #TNCG-RACK-HEADER or equal

2.21 Flat Panel Displays

A. Displays

1. Flat panel displays shall be commercial grade. Any displays used in common spaces shall be rated for 24/7 operation. All other locations shall be rated for 16/7 operation.
2. Flat panel displays shall support all necessary connections, including – at a minimum – two HDMI inputs and RS-232 control.
3. Flat panel displays shall have a minimum of 3840x2160p resolution (Ultra High Definition) except where noted otherwise
4. Flat panel displays shall have built-in speakers, except where the display is connected to a separate sound system
5. Manufacturers:
    a. Samsung
    b. LG

c. NEC (principles office)

d. Viewsonic (principles office)

e. Or FBISD approved equal

B. Mounts

1. Commercial grade mounts shall be used for all flat panel displays

2. Mounts shall match the size and load of the display

3. All mounts shall have downward tilt

4. Total depth of mount and display off the wall shall not exceed ADA allowed distance for protruding objects

5. Manufacturer:

a. Extending mounts – Chief, Peerless or FBISD approved equal.

b. Fixed mounts – Chief Fusion Series or approved equal

c. Height adjustable mounts - Mooreco iTeach 37745

C. In-Wall Equipment Box

1. Each display location shall receive a large flush-mount wall box. This box shall function as a centralized location for display connectivity (data, power, AV) as well as a space to house any electronics feeding or controlling the display.

2. The wall box shall include knockouts where single-gang boxes can be attached on at least three sides.

3. Manufacturer: Chief, FSR, Hoffmann, Legrand Wiremold, or approved equal

D. Storage

1. In rooms without a ceiling storage box or equipment rack, all AV equipment shall be mounted behind the flat panel display

2. Provide appropriate quantity and size of mounting accessories to securely mount all AV equipment components

3. Manufacturer: Chief component storage panels or approved equal

2.22 Interface Panels

A. Finish: Interface plates and connector panels shall be as indicated on Drawings and as specified herein. Finish on custom wall interface plates shall match that of electrical and other work and shall be coordinated with Consultant prior to ordering. Connector panels in equipment racks shall match finish of rack frame and specified/provided blank panels unless called out otherwise in equipment schedules.

B. Floor Boxes: Floor box plates shall be provided wherever connectivity through a floor box is indicated on drawings.

C. Labels: Interface plates and connector panels shall be engraved to show connector functionality. Engravings shall be finished with a contrasting color to plate finish.

D. Connector Placement: Verify connector layout detail for custom panels.

E. Box Mounts: Wall and floor interface plates shall mount to appropriate electrical conduit boxes unless indicated otherwise.

F. Cut-ins: Where no box is provided, Contractor shall cut in appropriate opening for plate, and provide appropriately sized mud-ring/caddy to securely attach plate to wall.

G. Rack Blank Panels: Contractor shall provide all blank rack panels necessary to fill opening in the front of AV equipment racks, whether specified in the equipment schedules or not.

2.23 Media Player

A. Professional/commercial-grade rack-mount media player

B. If used in a system that has video and audio, media player should support Blu-Ray, DVD, and CD playback.

C. If used in a system that has only audio, media player should support CD playback, Bluetooth, USB, and aux audio

D. Supports RS-232 and/or IP controls

E. Balanced audio outputs

F. Manufacturer:

1. Denon DN-700CB

2. Or FBISD approved equal

2.24 Microphones

A. Conferencing and Distance Learning Microphone Array

1. Manufacturer: Shure or FBISD design manager approved equal

B. Wired Microphones

1. Manufacturer:

a. Shure

b. Audix

c. Or FBISD approved equal.

C. Wireless Microphone Systems

1. 24-bit / 48 kHz digital audio
2. Single, dual, and quad receiver options; provide dual and quad receivers whenever wireless channels exceed two and four, respectively.
3. Networkable
4. Provide with rechargeable batteries (one per transmitter plus a spare for every three transmitters) and charging bays
5. Manufacturers:
    a. Elementary cafetorium - Shure MX20
    b. Other Cafetorium locations – Shure SLXD/SLX24
    c. Wireless Transmitter & Receiver: Shure ULX-D Series
    d. Earset & Lavalier: Point Source Audio CR-8S and CR-8L
    e. Fitness Headset: Shure SM31FH

D. Push-to-talk Microphones

1. Gooseneck on solid base
2. Manufacturer: Shure MX412D/C

E. Microphone Stands

1. Manufacturer:
    a. Floor:
        i. Atlas
        ii. K&M
        iii. Or FBISD approved equal.
    b. Desktop:
        i. Atlas DS7E
        ii. Or FBISD approved equal.

F. Microphone Receptacles

1. One-gang stainless steel plate with female XLR mic receptacle
2. Provide one for each wired microphone
3. Manufacturer: Neutrik or Switchcraft

2.25 Monitors

A. 22”-24” diagonal

B. 1920x1080 minimum resolution

C. Professional / commercial-grade with professional / commercial-use warranty

D. Height adjustable stand

E. Manufacturers: Dell, LG, Viewsonic, or equal

2.26 Power Solutions

A. Large Systems

1. Rack mount main sequencer with additional modules as necessary. Provide power sequencers at all large venue AV racks or any rack with an audio amplifier greater than 50W. Does not apply to systems where the amplifier is intended to remain on; ex: Energy Star amplifiers in ceiling enclosures.

2. Power output shall match recommended input power for system equipment. Main sequencer shall have 120V/20A output. Additional modules with 120V/30A or 220V/20A output may be required for certain amplifiers.

3. Provide with surge protection and remote switch

4. Minimum of six rear outlets and three sequenced groups of outlets

5. RS-232 and/or Ethernet control to interface with AV control system

6. Manufacturers: Furman, Middle Atlantic, Surge-X

B. Small Systems

1. Provide a rack mount 1 RU horizontal power strip with surge suppression at each equipment rack

2. Manufacturers: Furman, Middle Atlantic, Surge-X

C. Power Strips for Discrete AV Systems

1. Power strips shall be UL listed, surface mounted, rated for 115V-120V line voltage with a minimum current rating of 15A, and over-voltage auto shutdown AC surge protection at minimum.

2. To be used behind wall-mounted displays, within credenzas, or any location where commercial-grade, industry-standard power distribution is not a viable solution.

3. Provide type and quantity of power strips necessary to power all system equipment.

4. Manufacturers: Surge-X Flatpak, Tripp-Lite, Furman

2.27 Presentation Switchers

A. Mixture of digital video extender inputs, digital video extender outputs, HDMI inputs, and HDMI outputs. Quantity of each based upon needs of space.

B. Supports signal resolutions up to 4K/60 with 4:4:4 color sampling

C. Audio de-embedding to route audio from HDMI sources into sound system

D. May include built-in control processor

E. Manufacturer: Crestron, Extron, or approved equal

2.28 Projection Systems

A. Projectors

1. Laser light source
2. WUXGA (1920x1200) resolution minimum
3. Minimum of 100 fL (footLambert) image brightness on associated screen
4. Model with optional lenses for range of throw distances when necessary
5. Manufacturers:
    a. Epson
    b. Or FBISD approved equal

B. Projection Markerboards

1. The AV Contractor shall provide a specialty markerboard at every ultra-short throw interactive projector location to ensure a compatible surface.
2. The projection board shall be 5’H x 8’W, and shall be flanked by two 5’H x 5’W matching whiteboards.
3. Projection board shall be designed for maximum flatness with a guaranteed flatness of <3mm variation across the entire board surface.
4. Bezel cannot extend more than 3mm above the board surface so that finger touch unit can work.
5. Board shall be rigid enough to prevent flexing to ensure a superior interactive experience.
6. Magnetic porcelain steel surfaces
7. Minimum of 5 year warranty
8. Manufacturer: Mooreco Interactive Projector Board + Whiteboard System, 5’H x 18’W, #76451

C. Projection Screens

1. Widescreen aspect ratio, 16:10
2. Recessed in ceiling whenever feasible

3. Screen surface shall match installation conditions. For front projection, provide HD-compatible screen with 0.9, 1.1, or 1.3 screen gain depending on ambient light. For rear projection, provide screen surface capable of both front and rear projection. Minimum of 0.9 gain and 65-degree half angle.
4. Screen sizes shall be sized to provide clear visibility to the furthest viewer. Follow AVIXA sizing requirements.
5. The screen size and black drop will be calculated so that the bottom of the image area is approximately 48" above finished floor, and never lower than 42" AFF.
6. Refer to technology drawings for screen sizes and types per location.
7. Contractor shall coordinate exact mounting details with Architect
8. Manufacturer:
    a. Da-Lite
    b. Draper
    c. Or FBISD approved equal

D. Projector Mounts

1. Mounts should be appropriate for the projector size and installation conditions
2. Provide with protective cage when mounted in gymnasiums and other spaces where there may be projectiles or other potential damage.
3. Manufacturer: Chief
    a. 2x2 lay-in ceilings – Chief SYSAU Series
    b. Wall-mount long throw – Chief WMA2S dual stud wall mount
    c. Ultra-short throw – provide model recommended by projector manufacturer

2.29 Reception Intercom System

A. Provide a turnkey intercom system at the reception desk to enable audio communication between the visitor side (lobby) and the receptionist across the ballistic glazing barrier.

B. System shall support controls on the receptionist side, including on/off and volume up/down.

C. System shall include a local induction loop for assistive listening to support visitors with T-coil hearing aids.

1. Loop system shall be designed for an area of use for fixed listeners in a standing or sitting position at public reception counter as noted.

2. Loop system shall meet performance requirements set by the international standard for loop systems IEC 60118-4.

3. Loop shall be concealed, intended to be mounted beneath the desk surface avoiding metal structures and components.

D. Manufacturer:

1. Ampetronic TalkPerfect Kit3 (TP-K3); purchase through Listen Technologies

a. Combination microphone on receptionist side

b. Counter-top pod microphone and pod speaker on visitor side

c. Counter induction loop – Ampetronic CLD1

2. Or approved equal

2.30 Speakers

A. Refer to the speaker schedule in the technology drawings\

B. Acceptable manufacturers:

1. Library system:

a. JBL (preferred speakers - models LCT81 CT for ceiling speakers and JBL CCS1ST for wall-mounted speakers)

b. Quam (drop ceiling only)

c. Community (pendant speakers only)

2. Gymnasiums:

a. Octasound (elementary schools only)

b. JBL

c. Electrovoice

d. Community

e. Or FBISD approved equal

3. Cafeteria:

a. JBL

i. JBL AC599 (wall mount)

ii. JBL Control 18 C/T, JBL Control 226 C/T (ceiling mount)

b. Community

c. RCF

d. Or FBISD approved equal

4. Band Hall, Orchestra, Choir, Theater, Dance and Blackbox:
    a. QSC
    b. JBL
    c. Rankus Heinz
    d. Or FBISD approved equal
5. High school Auditorium:
    a. JBL
    b. Danley
    c. Sound Labs
    d. RCF
    e. Renkus Heinz
    f. Or FBISD approved equal
6. Stage Monitor Speakers:
    a. JBL
    b. QSC
    c. Or FBISD approved equal
7. Weight room:
    a. JBL
    b. Or FBISD approved equal

2.31 User Connectivity Interfaces

A. Provide at furniture locations to allow users to connect to power, data, and AV inputs without having to reach down to floor boxes or wall outlets.

B. Applies to conference tables, lecterns, and other furniture where noted in the AV system descriptions or on the drawing set.

C. Confirm exact model, color, and components with Architect prior to ordering.

D. Guidelines for configuration:

1. Include One Touch Retractors for HDMI and USB signals
2. Include at least one USB-C/A charging module
3. Include at least one Cat6 connector plate
4. Include at least one US Dual power module at lectern locations and at least two US Dual power modules at conference table locations

5. Include mounting shelf
6. Include ‘cloak’ cover

E. Manufacturer:

1. Hall research
2. Extron
3. Or FBISD approved equal

F. All faceplates and plate devices shall be coordinated with the architect to ensure that the finish is consistent with the aesthetic of the space

G. All device plates shall support the same signal transmission requirements as the interconnecting cables. Refer to the “Cables” sections for more information.

H. Passive HDMI plates shall include a pigtail on the back to facilitate appropriate bend radius and smooth transition into conduit.

I. Contractor shall provide custom plates where necessary to support the designed signal and/or connector types.

J. Manufacturers: Crestron, Extron, Liberty AV, or approved equal

2.32 Wireless Presentation Device

A. Wireless presentation connectivity, with support for Windows, macOS, Android, and iOS devices, with browser-based support for Chromebook and Linux

B. App-free sharing options including: AirPlay, Miracast, Browser sharing, Wired HDMI input

C. Support for touch and 4K UHD displays

D. Manufacturers:

1. Barco ClickShare
2. Crestron AirMedia
3. Extron ShareLink Pro
4. Mersive Solstice Pod

Part 3 - Execution

3.01 Equipment Location

A. Coordination: Where device locations are not shown on rack/console elevations and project drawings, Contractor shall coordinate with Consultant to identify desired/optimal locations.

B. Contractor shall verify all wall-mounted monitor mounting heights on preconstruction submittals.

3.02 Aesthetic Requirements

A. Printing: Button labels shall be engraved where applicable, or machine-printed where no engraved button/bezel is available. Handwritten labels are not acceptable.

B. Graphics: Icons and graphic representations of equipment and functions shall be crisp, sharp, and easy to identify. Icons shall be used wherever possible.

C. Text: ICS screens shall not use uncommon abbreviations. Text shall be sans serif and shall be sized to be clearly readable.

3.03 Equipment Configuration

A. Labeling: Contractor shall configure all equipment for normal use, including setting of levels and presets. Small adhesive labels shall be affixed to equipment indicating nominal levels and settings.

B. EDID, E-EDID: Where devices allow for the customization of EDID information, Contractor shall configure EDID settings of all applicable devices such that the audiovisual system is optimized.

C. Software: Contractor shall utilize Manufacturers official current version of configuration software. Special exemption may be obtained from Consultant if current version contains known issues. In such event, the version immediately preceding shall be utilized.

D. IP Interface: Contractor shall configure/modify IP-based monitoring software to allow Owner to monitor all rooms installed as part of this work. Automatic timed system shutdown shall be configured as part of this software. Shutdown time(s) to be coordinated with Owner.

E. Control System: Contractor shall make adjustments to programming as required by Consultant up to issuance of substantial completion punch list at no additional charge, so long as changes relate to equipment in this bid package.

3.04 Control Systems

A. Programming of AV system controls is the responsibility of the contractor. It is incumbent on the contractor to coordinate directly with the Owner, Architect, and Consultant for programmatic direction and design implementation. The contractor shall program all specified systems to provide a functionally complete turnkey solution.

B. Best Practices

1. The qualified control system programmer shall implement all industry best practices and manufacturer recommendations in the design and programming

of the control system regardless of whether they are explicitly described in this specification.

C. Basic Operational Functionality

1. Button Actions

a. When a button is pressed, the appearance of the button must change to reflect the action taken.

i. Momentary Functions (e.g., VOL UP) – State change is visible only while the button is being pressed.

ii. Maintained Functions (e.g., PLAY) – State change remains visible until another function is selected, resetting the previous state.

b. Provide debounce logic where appropriate to prevent unintentional activation.

2. System Activation and Deactivation

a. ON/OFF controls must be linked to current sensors or similar methods to detect the operational state of controlled components.

b. When System On is selected, the system shall turn on all audio features.

c. Powering on the video presentation system must trigger a sequence that automatically activates the projector, deploys the projection screen, and lowers motorized window shades to optimize the environment for viewing.

d. Conversely, powering off the video presentation system must trigger a sequence that powers down the projector, retracts the projection screen, and raises the window shades, restoring the environment to its default state.

i. Note: Powering off a system shall not interfere with a projector's cool down cycle.

3. Navigation

a. Provide intuitive navigation tools for moving between pages, such as a "BACK" button on all sub-pages, with a consistent location on every page that it appears.

4. Screen/Shade Controls

a. The control system for motorized projector screens and window shades must support Up, Down, and Stop functions. The Stop function should allow users to halt movement at any point, after which pressing the Up or Down button will resume travel in the respective direction.

b. The system must integrate seamlessly with wall-mounted controls, ensuring they remain fully functional and independent of the touch panel control system.

c. Touch panel interfaces should provide direct access to screen and shade controls, minimizing the need for users to navigate through multiple menus or control pages to operate these features.

5. Include a “HELP” button or icon in a consistent location on every page with clear, non-technical usage instructions.

D. Common Equipment/Feature Control Requirements

1. Audio

a. The contractor shall provide discrete source selection and gain (volume) control over audio sources such as mic-level sources, line-level sources, video sources, etc. Where buttons are specified for audio level control, each press of a button shall adjust the gain or volume in 1.5dB increments.

b. Where possible, each audio source control shall be equipped with a visual meter to provide real-time feedback of the signal level. This meter shall display loudness levels in reference to the signal limits established at the final stage of the signal chain for the respective audio source.

c. All audio source controls shall include a discrete “MUTE” button which, when activated, shall serve to silence any audio output from the associated source, overriding any volume level settings without altering them. The button typically provides clear visual feedback, such as changing color, icon state (e.g., a crossed-out speaker), or illumination to indicate the muted status. The control may support momentary or toggle behavior, depending on system configuration, and is often implemented with debounce logic to prevent unintentional activation.

2. Video

a. The Video Source Selection feature within the AV system user interface allows users to choose from multiple video sources (e.g., laptop, media player, streaming device) for display on the designated output device(s). Selecting a video source dynamically routes its associated audio signal to the appropriate audio output, ensuring proper synchronization between video and audio streams.

b. The user interface should provide a clear, intuitive selection mechanism, such as labeled buttons or a dropdown menu, with immediate feedback indicating the active video source. Source switching should occur seamlessly, with minimal latency, to maintain a smooth user experience.

c. A visual audio signal meter must be displayed on the interface, providing real-time feedback on the loudness level of the selected video source. Audio controls for the selected video source, as described above, must be easily accessible, allowing users to monitor and adjust volume levels directly through the interface for an optimal listening experience.

d. Additionally, all microphone audio sources remain active and available regardless of the selected video source. This ensures that voice

reinforcement or conferencing capabilities function consistently, independent of the content being displayed. The system should integrate automatic mixing to balance microphone audio with the selected source's audio output, maintaining an optimal audio experience for all participants.

3. Media Player Transport Controls

    a. Basic user controls for media players shall be incorporated into commonly used pages of the UI. Typical controls include (but are not limited to) Play, Stop, Pause, Fast Forward, and Rewind.

E. Visual Requirements

1. User Interface Aesthetics

    a. Control pages must feature a clean, elegant, yet stylish design. All control pages must use a common graphical template for a cohesive look. Use elements such as drop shadows, gradient fills, and transparency to enhance visual appeal. Include company/facility logos, icons, or watermarks to reflect branding.

    b. Incorporate graphical representations of floor plans to convey location information.

2. Colors

    a. Color Coding: Control functions must use a consistent color-coded scheme to enhance clarity and indicate relationships between different control groups.

    b. Red: Reserved exclusively for “muted” status, signaling faults, or abnormal conditions.

    c. Green: May indicate normal operation and can also be used as a standard control color.

    d. Consistency: Similar controls must maintain the same color scheme across all control pages.

    e. State Indication: When a function is selected, the button or graphical element must visually appear pressed and change to a darker shade of the regular button color.

    f. Background and Foreground: Color schemes for backgrounds and foreground objects must be complementary and maintain a consistent theme throughout all control pages.

3. Buttons, Text, and Iconography

    a. Buttons must be no smaller than 3/8” wide by 1/4” high and must have a minimum spacing of 1/16” between them. For buttons that are immediately adjacent, the active selection area must be reduced to 80% of the visual button area to prevent accidental activation.

b. Labels shall use simple words or titles to indicate functionality, navigation, and system status. Avoid using stylized symbols unless they are widely recognized, such as standard transport icons (e.g., Play, Pause). All text shall be a clear, sans-serif typeface to ensure readability, even on lower-resolution touch panels. For control panels with physical buttons, engrave labels and fill them with a contrasting color for visibility, or provide permanent print on clear buttons with LEDs inside for visual feedback.

    i. Note: The contractor shall ensure that print on physical buttons cannot be rubbed off or fade over time.

F. Divisible/Combinable Spaces

1. Multiple touch panels in a combined space must be synchronized to display identical user interface states and functionalities in real time. Any interaction with one panel—such as navigation, control adjustments, or status changes—is immediately reflected across all other mirrored panels. This is achieved through a centralized system controller that processes user inputs and dynamically updates all connected panels. Touch panel synchronization ensures consistent user experience, enabling seamless control from any panel, and may involve mechanisms for conflict resolution if simultaneous inputs are detected. Network reliability and low-latency communication are critical to maintaining synchronization.

2. Combining adjacent areas shall be done through a graphical representation of the physical areas to be combined. Use of a floor plan metaphor is recommended with the graphic oriented correctly with respect to control panel location.

3. Use buttons or other appropriate objects placed along the common wall to enable the combining function.

4. When spaces are combined, the graphic appearance of those areas shall change to reflect this configuration. Once an area is separated from a combination, the color of its area should revert to the normal room color.

5. Common control functions between combined rooms shall be linked, allowing control of the combined area from any one of the touch panels. Examples of common functions include:

    a. Background music selection

    b. Background music volume

    c. Background music muting

    d. Lighting preset recall

    e. Master volume (not individual channel volume)

6. When combining adjacent rooms, the control system shall force the common functions to a predetermined default configuration, so all rooms have the same configuration.

7. To avoid unintentional changes, a control panel shall not be able to operate a function in a remote location without also operating that same function in the room where the panel is located.

G. Presets

1. The system must support the storage and recall of preset configurations for various operating modes, camera positioning, video display configurations, etc. The contractor shall coordinate closely with the Owner to determine all desired use-case scenarios for the system and the best preset configurations to support those scenarios.

2. The contractor shall provide a dedicated “Preset” page for recalling presets, each labeled to describe its associated configuration. All preset control pages must clearly display which preset is currently active.

3. The Owner shall be allowed to overwrite existing presets with new settings and update labels to reflect the changes.

H. Security

1. Provide password-protected access to sensitive control pages with a minimum of three access levels:

a. General User

b. Non-Technical Employee

c. AV Technician

2. Advanced control pages shall be restricted to authorized personnel only. A timeout feature shall be included which shall revert the touch panel to the default home screen after 30 seconds of inactivity, requiring re-entry of passwords for restricted pages.

3.05 Digital Signal Processor

A. Processor power required of DSP shall not exceed 80% total processing capacity. If processing power required exceeds available processing power, Contractor shall immediately notify Consultant during pre-installation phase.

B. Functional Requirements

1. Functions: The DSP shall be configured to provide:

a. Pre-amplification

b. Filtering and Equalization

c. Dynamics processing

d. Gating

e. Mixing, Automatic mixing – gain sharing or gated

f. Zoning

g. Mix-minus

h. Delay

i. AEC

j. Volume control

k. Emergency/Alarm muting

l. Signal metering

m. Logic functions

2. Gain Structure: The DSP shall be configured to obtain and maintain unity gain structure from input pre-amplification stage to output stage or associated end-user volume control.

3. AEC: The DSP shall be configured to provide AEC for all microphones detecting echo in conferencing and specialty DSP applications. AEC shall be configured per DSP Manufacturer's recommendations and best practices.

4. AEC and Pre-AEC: Where microphones used for speech / sound reinforcement are part of a conferencing system requiring AEC processing, the "Pre-AEC" audio path shall be utilized for speech / sound reinforcement while a separate path processed for AEC shall be utilized for conferencing.

5. Organization: Referring to open-Architecture DSP platforms. Processing objects shall be clearly labeled and organized clearly to follow the intended signal path from left to right, top to bottom. Connection lines between objects shall be routed in an organized fashion.

6. Multiple DSP: Where designs include more than one DSP linked via virtual multi-channel audio buss or digital audio network, all signals shall be routed to a central processor for master routing and 3rd party control. All control points being controlled by ICS controls shall be located on a single DSP operating as the master unit.

7. Latency: Also known as propagation delay, Programmer shall utilize sufficient and efficient processing paths to achieve intended results whilst minimizing latency from input to output.

C. DSP Controls

1. Contractor shall coordinate work of ICS Programmer and DSP Programmer.

2. Volume controls shall be range limited within DSP to provide end-user with adequate adjustment range (typically +/-6dB for microphones and +/-10dB for presentation sources). Operation of DSP from end-user standpoint shall be seamless with ICS system operation.

3. Processing objects within Audio DSP configuration shall be clearly identified where controlled by ICS. Text objects or similar shall identify these objects.

3.06 IT Coordination

A. General: Where connections between components or control features are accomplished over the Owner's LAN, the Contractor shall coordinate with the Owner's IT department for IP addresses, firewall access, and other issues pertaining to successful integration.

B. Permission: It is the Contractor's responsibility to obtain the necessary information and permissions to implement their system. Any delays or problems with gathering information or coordinating access to the LAN or WAN shall be brought to the Consultant immediately for resolution.

C. Wireless Frequency Coordination.

1. The system designer shall coordinate the wireless frequency with local conditions for every location. Wireless frequencies shall be coordinated to be in bands and channels specifically reserved for wireless microphones.

2. The system designer shall use the Shure SLX series in the J3 band (572-596 MHz) for value microphone selection with less than five microphones in the immediate area. The G5 band (494-518 MHz) shall be an alternate band as required.

3. The system design shall utilize the Shure ULX-D series microphones for performance wireless microphone systems with more required channels. The X52 band (900 MHz) is the preferred band. Under site conditions where the 900 MHz is not free and clear of interfering systems, a combination of J50A band (572- 620 MHz) and H50 band (530-602 MHz) is also acceptable.

4. Alternate wireless microphone manufacturers are subject to the same frequency coordination requirements.

D.

E. Wireless Access Points: In systems where there is a dedicated AV network with it's own WAP(s), the Contractor shall coordinate with the Owner's IT department for all WAP channel configuration, placement, and coverage. Ensure audio visual control system WAP is not treated as a rogue WAP by the Owner's wireless management system.

3.07 System Testing

A. Prior to commencing any work in an existing building, the systems shall be fully tested to document the condition of the systems.

B. Contractor shall check that all cables are properly labeled and secured prior to substantial completion inspection.

C. Contractor shall ensure that all work areas are clear of all debris, tools, empty boxes, and extra parts prior to substantial completion inspection.

D. Prior to the substantial completion inspection, Contractor shall notify the Consultant that all items listed below are complete:

1. Contractor shall ensure that all standard functions of equipment are functional.

2. Contractor shall verify all input and outputs of the system for signal quality.

3. Audio: Contractor shall verify all sources are free of destructive noise (excessive noise floor, hiss, grounding interference) and that speakers function properly. The audio system shall be consistent in terms of volume and tone and shall be optimized for the space(s) served by the audio system.

    a. Control functionality, verification of presets, volume controls, mute controls, etc.

    b. Stable operation, completely free of feedback and distortion throughout entire range of available ICS controls.

    c. Correct routing of all signals to intended destinations.

    d. Unity gain structure.

    e. Output transducer (speaker) protection processing functionality.

    f. AEC functionality.

    g. Provide measurement test results per ANSI/InfoComm 1M-2009 ACU.

    h. Outdoor sound system measurements shall be provided at a minimum of one measurement location per 50 seats. Measurements shall be performed using pink noise test signal at a volume congruent with nominal system operation. Measurements shall indicate:

        i. Site plan map of seating areas and test locations.

        ii. Frequency response from 80Hz-16kHz in 1/3 octave resolution.

        iii. SPL (A weighted) of the test signal as measured from each location.

        iv. Weather conditions at time of test; including temperature, humidity and average wind speeds.

4. Video: Contractor shall verify that all EDID and EDID-D information has been configured at each video transmission and processing device. Where signal processing is present, Contractor shall optimize the video system to native resolution of display devices.

E. Testing & Adjusting

1. The Contractor will be responsible for adjusting the installed system and notifying the Consultant when system adjustments have been completed:

    a. In accordance with Construction Documents

b. As required, to provide the Owner a fully functional system at system turnover

c. As directed by the Consultant

2. Audio System Equalization

a. Using a Real-Time audio frequency spectrum analyzer, such as Audio Control SA-3052 or equivalent, with both 1/3 band and narrow band display, equalize all loudspeaker systems to provide a suitable frequency response as follows:

i. For each indoor sound system measurements shall be provided at a minimum of one measurement location per room quadrant - (approximately 100 square feet). Measurements shall be performed using a pink noise test signal at a volume congruent with nominal system operation.

ii. Measurements shall indicate:

a. Floor plan map of room, seating areas and test locations.

b. Flat Frequency response from 60 Hz to 20 kHz + or – 1-1/2db with a 1db per 1/3 octave roll off after 2kHz.

c. SPL (A weighted) of the test signal as measured from each location.

d. Load and save the final normal settings in the DSP as preset one and record same settings including system gain and amplifier level settings in the As-Built Project Manual

F. Notification: When above tests have been completed and system is ready for inspection, notify Consultant in writing at least seven working days prior to inspection. Include in this notice copies of all data recorded, date each test was completed and results of each test. All test data shall be available during inspection process.

G. Immediately prior to final inspection, in the presence of Consultant and/or Owner representative, Contractor shall load DSP program and integrated control system program from Closeout Submittal media and demonstrate full system functionality.

3.08 Firmware

A. Firmware upgrades shall be dated the same as Date of Acceptance. Contractor shall upgrade firmware and software as necessary during project so that latest versions are installed as of Date of Acceptance.

3.09 Training

A. General Information: As required by Sections 27 00 00 and 27 40 00.

B. Contractor shall provide one (1) 60-minute training session for each unique audiovisual room type. Training sessions shall comprise of one half of the time

dedicated to instructor led training with the remainder of the session to be used for instructor supervised hands-on end user operation of the system(s):

1. Identification of input locations, source devices, control locations, displays, and other devices requiring end user interaction for successful system operation.
2. Use of control system.
3. Use of source devices and input locations.
4. Switching inputs for each display.
5. Training shall include operation of system in event of control system malfunction – all manual switching and use of remotes.
6. Basic troubleshooting for common user errors.

C. Scheduling: Training shall be scheduled with Owner at least ten (10) days in advance.

D. Quick-Reference Guides: Contractor shall compile quick-reference guide for system operation and basic troubleshooting. Quick-reference guide shall be provided at the training session, and training shall include walking through quick-reference guide steps.

End of Section

Section 27 51 13 – Paging System

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. System installation shall include, but not be limited to, installation, programming, and configuration of system components and all associated software upgrades, patches, and maintenance for the first year.

C. Full system functionality must be maintained during additions and renovations in unaffected areas.

D. Remove and disconnect abandoned PA equipment. Remove any abandoned cabling above ceilings and patch all penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

E. Provide a programmable and addressable system to every occupied space and to the exterior of the building.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 60 00 – Physical Security General Requirements

I. Section 27 62 00 – Electronic Access Control System

J. Section 27 64 00 – Video Surveillance System

K. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional requirements.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor will have a minimum of 5 years of experience with Intercom systems.

C. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the distributed communications system(s) being provided.

D. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the distributed communications system(s) hardware.

E. Submittal: Certification certificate shall be submitted with distributed communications system(s) submittals.

F. Certifications for all required qualifications will be included with the pre-construction submittals.

1.06 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

C. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in the preceding section above.

D. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

E. Color Selection List

1. Provide a list of all paging equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to speakers, volume controls, microphoens, and input plates.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Paging Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner

reserves the right to object to an installed device's color and require that the Contractor replace it at no cost to the Owner

F. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

G. Shop drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, speaker tap values based on speaker models and installation conditions, cable routes, maximum cable distance calculations, zone delineation map, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Equipment Rack/Cabinet & Wall Equipment Elevations: Include placement of all rack/cabinet or wall-mounted equipment, drawn to scale

d. Amplifier power calculations

1.07 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor shall provide additional information when required by the Owner to assist them in assigning IP addresses.

1.08 Closeout Documents

A. Refer to Section 27 00 00 for additional requirements.

B. All software, configurations, programming, passwords, etc. required for FBISD to make routine changes to the system for bell schedules, zoning, etc must be provided.

1. Provide a dedicated computer with the PA software installed. This computer would stay onsite so that administrators could add/delete schedules as required.

2. Coordinate with FBISD IT for the PC requirements.

C. Electronic pdf as-built drawings in 11" X 17" format will be required for final closeout of the project. Close out drawings must include details indicating the actual wiring layout and installed locations of all devices such as speakers, handsets, etc. Close out drawings must also include model numbers and serial numbers of all equipment installed. Laminated PDF copies of the as-built drawings shall be mounted next to the panels in the MDF / IDF Rooms.

1.09 Pre-installation Procedures

A. Refer to section 27 00 00 for additional requirements.

B. Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to the system.

1.10 Mounting and Installation

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where devices will be located.

B. Exterior devices shall be installed in a sealed backbox with a weather hood.

1.11 Code and Standard Requirements

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. Other applicable codes and standards are as follows:

1. ANSI/IEEE C2 – National Electrical Safety Code

2. NFPA 70 – National Electrical Code

3. TIA/EIA 568-C-1, 2, 3 Standards

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Paging System General Description

A. The Contractor shall provide a turnkey paging and public address system that meets all the functional requirements described in this specification plus any additional features necessary to make the system fully operable.

B. The Contractor shall provide all components necessary – both hardware and software – to support a fully functional system, regardless of whether they are explicitly described in this specification. Any Contractor responding to this specification must be an experienced integrator of the solution they are proposing.

C. Provide a programmable and addressable system to every occupied space and to the exterior of the building.

D. Provide for 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.

E. 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.

F. The public address system shall provide for bell changes and shall be capable of storing events, schedules, programmable holidays, bells silenced, etc.

G. Provide for integration with the synchronized wireless clock system.

H. rovide data network cables as required for network connectivity.

I. The public address system shall be provided with a UPS with a (60) minute capacity.

J. The public address system shall be connected to the emergency generator, when available.

K. The public address system must integrate with the FBISD Cisco VoIP phone system

1. An FXO interface will not be accepted.

2. 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.

3. FBISD will configure the ATA190 on the Cisco Call Manager.

4. 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.

L. Provide for the increase of stations by 25 percent above those required for the initial design without adding any internal or external components.

M. The public address system shall not be located within the MDF room or IDF room. Design Consultant to coordinate with architect and MEP to find wall space for the pa system and any cross termination required . 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.

N. Provide the following program sources installed in a remote desk intercom cabinet installed at the reception area.

1. AM / FM Receiver/CD with Mixer/Preamp and Monitor Loudspeaker

2. CD/MP3-iPod Player

3. 8-input stereo mic/line mixer

O. Areas equipped with local volume controls shall have an emergency override circuit.

P. Speakers in wet areas shall have moisture resistant features.

Q. Provide transient and surge protection on both ends of the cabling run for any component exposed to the exterior.

R. Provide zone controllers as necessary.

S. The system shall be capable of connecting to a VoIP telephone or analog PBX system to initiate intercom calls or pages.

1. The Contractor shall provide the interface that is compatible with the Owner's system.

T. The system shall be fully firmware and software upgradable from a centralized network location.

U. All software required for programming and licenses required for operation of the system shall be provided.

V. The system shall include the ability to play music and other auxiliary audio sources via a line level input.

W. The system shall have the ability to store audio files

X. The system shall provide the ability for 2-way intercommunication ("talkback") to each individual classroom or other designated space. Talkback paging shall be initiated only from a master station or from a call button within the room (if shown on plans).

1. [list talkback location requirements here]

Y. The system shall have the ability to schedule recurring playback of recorded audio files, including music, bells, and recurring announcements. The scheduling software shall allow users to create multiple bell/event schedules and simply apply these to various days on a recurring basis (ex: a different schedule for Monday/Wednesday/Friday and Tuesday/Thursday). The scheduling shall include a calendar interface so that it can be revised for each individual calendar day without affecting the other dates in that recurring sequence.

2.03 Paging System Software

A. The Contractor shall install client station software for the administration and management of the system on xxx (##) workstations of the Owner's choosing.

2.04 Paging System Manufacturers:

1. Bogen
2. Carehawk
3. Rauland
4. Telecor XL

2.05 Paging Zones

A. Zoning shall be coordinated with FBISD Design Manager during the design phase for each project. At a minimum, sixteen (16) 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:

1. One zone for inside classroom speakers [GRADE K] through [GRADE 1]
2. One zone for inside classroom speakers [GRADE 2] through [GRADE 3]
3. One zone for inside classroom speakers [GRADE 4] through [GRADE 5]
4. One Zone for inside classroom Speakers [GRADE 6]
5. One Zone for inside classroom Speakers [GRADE 7] through [GRADE 8]
6. One Zone for inside classroom Speakers [GRADE 9]
7. One Zone for inside classroom Speakers [GRADE 10]
8. One Zone for inside classroom Speakers [GRADE 11]
9. One Zone for inside classroom Speakers [GRADE 12]

10. One zone for gymnasium speakers
11. One zone for cafeteria speakers
12. One zone for common area speakers
13. One zone for administration areas
14. One zone for teacher's lounge and workrooms
15. One zone for outside speakersAudio Amplifiers

2.06 Paging Amplifiers

A. The Contractor shall furnish and install the appropriate number and size of amplifiers to support the system, taking into account the quantity of speakers, anticipated tap values, signal loss over cable distance, number of zones, and other associated factors.

B. Amplifiers shall never operate at more than 80% of their rated power.

C. Manufacturers:

1. Any of those listed as overall system manufacturers, plus:
2. Ashly
3. Crown
4. QSC
5. Or FBISD approved equal

2.07 Cable

A. Cable shall be provided and installed that meets the manufacturer's recommendations for equipment and signal types that are being transmitted.

B. UTP cable (Cat6, Cat6A) shall meet the requirements identified in 27 15 00 Communications Horizontal Cabling.

C. 25v/70v speaker cable shall be a minimum of 16 AWG, 2-conductor, twisted cable.

D. 25v/70v speaker cable with volume control bypass trigger shall be a minimum of 16 AWG, 4-conductor, twisted cable.

E. All public address system cabling shall be plenum rated.

F. All public address system cabling shall be white in color.

G. All cables shall follow the same pathway requirements as stated in spec sections 27 05 28.

H. All cabling shall be properly supported from the structure using j-hooks.

I. J-hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray.

J. J-hooks shall be installed utilizing appropriate hardware to support, join and attach j-hooks to structures.

K. Provide spare conduits at bulk heads, furr downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.

L. No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.

M. Manufacturers:

1. Belden
2. Liberty
3. West Penn
4. Windy City Wire

2.08 Equipment Cabinet

A. A. Provide the quantity and size of racks necessary to support the full system with room for 30% future growth.

B. Manufacturer:

1. Middle Atlantic BGR-SA Series
2. Or approved equal

2.09 Speakers

A. The appropriate speaker type shall be installed at each location based on the architectural conditions of that space, including the ceiling type, ceiling height, presence or absence of moisture, light fixtures, wall construction, and other characteristics. The technology floor plans may provide a speaker type number at each location, but it shall be the Contractor's responsibility to ensure the speaker type that gets installed matches the architectural conditions at the time of installation.

B. The speaker models listed below shall be the basis of design, and any proposed substitutions must match the performance characteristics of the specified models.

C. All speakers shall be provided with the appropriate transformer type and/or IP interface necessary to work with the overall system and achieve the functionality described.

D. All speakers shall be provided with the appropriate mounts and accessories necessary for installation.

E. In addition to their primary means of support, all ceiling-mounted speakers shall have a 2-point security wire attached to the building structure to prevent the speaker from falling if the ceiling should lose its structural integrity.

F. Provide speakers in the following locations:

1. Classrooms
2. Offices
3. Conference Rooms
4. Administrative Areas
5. Corridors
6. Gymnasiums
7. Cafeteria
8. Restrooms
9. Common Areas

G. Exterior Perimeter of Entire Facility

1. Exterior speakers shall be provided with surge protection
2. Exterior speakers shall be weatherproof / program speakers.
3. Speakers shall be UL listed for flush mounted waterproof type paging speakers for voice and tones with matching transformer.

H. Manufacturers:

1. Atlas
2. Lowell
3. Quam Nichols
4. Or FBISD approved equal

2.10 Call Buttons

A. Single-gang device

B. Match plate color with light switches or provide in stainless steel if no matching option is available.

C. One or more buttons to alert the system administrator (typically the front desk staff) that they need assistance.

D. Two or more priority levels, either via separate buttons or other mechanism (press-and-hold, multi-press, etc.), to allow users to engage a standard call or an emergency/urgent call.

E. Visual feedback to show users their call status.

2.11 Volume Controls

A. Single-gang device

B. Rotary volume control knob with hard stops at lowest and highest settings (no continuous rotation)

C. Match plate color with light switches or provide in stainless steel if no matching option is available.

D. Provide volume control wattage as appropriate for the downstream load.

E. Provide solution with priority bypass relay for emergency override such that users in a volume-controlled area still receive all emergency announcements.

F. Provide volume control in the following locations:

1. Offices
2. Conference Rooms
3. Administrative Areas
4. Large Teaching Areas
5. Special Education Classrooms
6. Auditoriums
7. Band
8. Orchestra
9. Choir
10. Cafeteria

2.12 Master Station

A. The master station (also referred to as an admin console, or front office console) shall include an integrated video display, speakerphone, and telephone handset. The master station shall allow users to select any zone or grouping of zones, including individual classrooms if applicable, and make a live announcement or initiate a pre-recorded announcement or other audio file.

B. Provide administrative handsets with 12-digit keypad to transmit calls to other stations and initiate commands for programming and operation at the following locations:

1. Front reception desk
    a. Provide microphone with desk stand and integral-locking, press-to-talk switch.

2. Principal office
3. Assistant Principal's Office
4. Nurse's Office
5. Attendant's Office

C. Each dialing administrative telephone in the system shall be programmable for the following options:

1. Allow zone paging
2. Allow All-Page announcements
3. Allow Executive Override
4. Allow Emergency Paging
5. All activation of Time Zone tones
6. Set the priority level and target display or "normal" calls
7. Set the priority level and target display of "emergency" calls
8. Assignment of architectural number
9. Class of service
10. Assignment of associated speaker to paging zone
11. Automatic Call-Back Busy
12. Call Forward-No Answer
13. Call Forward-Busy

2.13 Uninterruptible Power Supply (UPS)

A. A. Provide a UPS battery backup for continuous operation during power failure for 30 minutes at half load.

B. Manufacturers:

1. APC
2. Middle Atlantic
3. Tripp-Lite

2.14 Local Sound System Integration

A. Provide a hardwired audio feed into every local sound system. This includes small-scale AV systems (classrooms, conference rooms, etc.) as well as larger sound systems for event spaces (gymnasiums, auditoriums, etc.).

B. Coordinate the connection point and requirements with the AV Contractor. Typically, the feed goes to the AV rack and terminates at an audio processor or mixer. In the case of smaller rooms, this location may be behind the display or in a ceiling enclosure.

2.15 Fire Alarm Integration

A. Provide a hardwired direct connection between the fire alarm system and the paging & public address system. Coordinate the wiring requirements and panel location with the Fire Alarm Contractor.

B. Confirm with Owner and Fire Alarm Contractor how the paging/PA system should respond to a fire alarm event. Provide all necessary equipment, wiring, and programming to support any of the following scenarios:

1. Mute the paging/PA system during a fire alarm event
2. Duck the paging/PA system during a fire alarm event
3. Play pre-recorded message during the fire alarm event.

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide for (4) hours of training for two (2) persons on each system.

C. Training shall be conducted on-site with a manufacturer's representative.

D. Training / demonstration shall provide for a "user's manual" written specifically for the school personnel onsite, for daily routine operations of the system.

E. Provide a test report showing the system has been 100% tested and is 100% operational prior to training / demonstration.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional intercom and PA system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.05 Phone System Integration

A. The Contractor shall connect the paging system to the Owner's IP phone system via a SIP trunk to allow paging from the phone system.

3.06 System Configuration

A. The Contractor shall work with the Owner to create (or import) their bell schedule.

B. The Contractor shall obtain building floor plans and load them into the paging headend hardware/software.

3.07 Coordination

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with network configuration.

B. Verify that the manufacturer approved or recommended server hardware and operating system meets the Owner's IT department standards prior to ordering.

C. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

D. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.08 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in four (4) three (3) hour sessions for administration and management of the systems.
2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance personnel.
3. Provide printed training materials for each trainee, including product manuals, course outline, workbook and student guides.
4. Provide hands-on training with operational equipment.
5. Training shall be oriented to the specific systems being installed under this contract as designed and specified.
6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.09 Aesthetics

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. All surface-mounted devices shall be firmly secured level and plumb

D. All rack mount equipment shall be securely installed.

3.10 Hardware Layout

A. Hardware positioning and layout shall be reviewed and approved by the Consultant and Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.11 Device Cabling/Wiring Installation Practices

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. 70-Volt speaker cabling shall not share cable pathways with other cabling.

D. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

E. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

F. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

G. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

H. Cables shall not run above red iron joist.

I. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

J. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

K. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

L. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

M. No splices shall be installed in any UTP cable unless prior approval from Consultant is given.

3.12 Cable Termination

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.13 Integration with Physical Security Systems

A. The intercom system shall be integrated with the video surveillance system, electronic access control system and intrusion detection systems.

1. The integration interface shall be via an Ethernet interface.

2. The intercom to video surveillance integration shall be via SIP (Session Initiation Protocol) interface.

a. The intercom stations shall operate in a SIP to SIP mode with the video surveillance system listening and recording the audio to the associated camera time synchronized for seamless video/audio playback.

B. The intercom stations shall be associated with cameras from the video surveillance system.

C. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

D. The Contractor shall provide any needed expansion boards for integration.

E. The system shall integrate with Microsoft Active Directory.

F. The system shall integrate with Microsoft Exchange Server for the purpose of sending email notifications.

G. Refer to each integrated systems specification sections for additional specific integration requirements.

H. The intercom and PA systems shall be time syncing to a common NTP server as all the integrated systems.

I. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the installation and integration starts.

3.14 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for this Contractor and left unused shall be sealed up by this Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

D. Any existing openings discovered that should be fire stopped should be brought to the attention of the Owner.

3.15 System Testing Procedures

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

B. Contractor shall ensure that each device in the system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

C. Contractor shall be responsible for the following testing procedures:

1. Measure each area's ambient noise level during normal business operation.

2. Provide amplifier(s) and estimate speaker transformer tap values that provide acceptable performance without exceeding 80% of the amplifier's RMS power.

3. Acceptable performance is deemed to mean that a voice page or intercom call is 15 dB over the Ambient Noise level when measured at 5 feet above finished floor. Make all necessary adjustments per Owner and Consultant request.

D. This Contractor is ultimately responsible to ensure the overhead paging system voice pages are a minimum of 15 dB over the Ambient Noise Level in each area without exceeding 80% of the amplifiers' rated power.

E. Inspection: After Contractor's testing is complete and the system is properly adjusted, the Contractor shall contact the Owner to schedule a "spot test" of the system with the Owner and Consultant. Contractor shall make changes/adjustments per Owner and Consultant's request at no additional cost to Owner. These adjustments may include but not be limited to:

1. Adjusting volume control of amplifier.

2. Adjusting local volume control of individual speaker.

3. Re-tapping up to 20% of speakers at different wattage.

3.16 System Inspection

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

3.17 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 00 00 and 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.
2. Contractor shall provide a document including the following:
    a. Device label/identifier
    b. Location of each drop by orientation/permanent landmark in the room
    c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.18 Pre-Checkout

A. The Contractor shall demonstrate the following to Owner during system demonstration:
    1. The intercom stations are fully installed and functional.
    2. Calls can be placed and operate in full duplex mode.
    3. All-call functionality is working correctly.
    4. Individual zones can be paged.
    5. Integrations are functional.

3.19 Final Acceptance

A. In addition to closeout requirements in section 27 00 00 and 27 60 00, This Contractor shall demonstrate the following before final approval.
    1. Owner training is complete.
    2. Punch list items are complete.
    3. As-built documentation is complete and submitted to Owner/Consultant.

3.20 Final Procedures

A. Perform final procedures in accordance with section 27 00 00 and 27 60 00.

End of Section

Section 27 53 13 – Synchronized Clock Systems

Part 1 - General

1.01 Scope

A. This section describes the products and execution requirements relating to synchronized clocks and connection to a master clock if applicable.

B. Full system functionality must be maintained during additions and renovations in unaffected areas.

C. Remove and disconnect abandoned clock equipment. Remove any abandoned cabling above ceilings and patch wall and floor penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 15 00 – Communications Horizontal Cabling

D. Section 27 16 00 – Communications Connecting Cords

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor will have a minimum of 5 years of experience with Intercom systems.

C. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the distributed communications system(s) being provided.

D. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the distributed communications system(s) hardware.

E. Submittal: Certification certificate shall be submitted with distributed communications system(s) submittals.

F. Certifications for all required qualifications will be included with the pre-construction submittals.

1.06 Pre-Construction Submittals

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Color Selection List

1. Provide a list of all synchronized clock equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (e.g., an Architect) can understand. Examples of such items include analog and digital clocks.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Clock Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device's color and require that the Contractor replace it at no cost to the Owner.

D. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

1.07 Construction Progress Submittals

A. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor shall provide additional information when required by the Owner to assist them in assigning IP addresses.

B. Refer to Section 27 00 00 for additional requirements.

1.08 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 General requirements

A. The wireless clock system shall integrate into the public address system and bell schedule to provide for storing events, schedules, programmable holidays, bells silenced, etc.

B. The wireless clock system shall function autonomously, meaning it does not rely on Wi-Fi or Bluetooth technology.

C. It is preferred that the wireless clock system does not require an FCC license. If an FCC license is required, it shall be provided by the manufacturer / integrator of the wireless clock system.

D. Manufacturers:

1. American Time & Signal
2. Bogan
3. Sapling
4. Or FBISD approved equal

2.02 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.03 Master Clock

A. The master clock shall provide but not be limited to the following functions:

1. Up to (16) programmable schedules.
2. Selection of any of (16) schedules to allow flexibility due to seasonal changes or special events.
3. Bells to be silenced or special schedules to be implemented for special events.
4. Non-volatile memory capacity for storing up to 500 events and up to 100 calendar dates for schedule changes
5. Ability to review, edit and delete events via Windows PC running the configuration program

6. Events shall be programmable to any or all zone circuits.
7. User programmable Automatic Daylight Saving Time Change
8. Separate bell tone selection and separate bell duration for each event

B. Provide a centralized master clock compatible with the secondary clocks indicated below.

C. The master clock shall support a web interface that allows you to program it from any Internet connection.

D. The clocks provided in this project must be compatible with the Owner's existing master clock / time server. The Contractor shall be responsible for connecting and configuring the clocks to follow this master clock.

1. Existing master clock: zzz

2.04 Analog Secondary Clocks (used at Elementary schools)

A. Provide clocks at all locations indicated on the technology plans. Analog clocks are designated with a subscript "A" and a number to indicate single ("1") or double-sided ("2").

B. Clock technologies

1. Wireless, battery-powered (5-year battery lifespan)

C. All clocks shall have built-in self-diagnostics and be configured for email alerts when there are the following errors:

1. NTP synchronization timeouts
2. Power resets
3. Hand position errors and corrections

D. Clock requirements:

1. Round 12" double face
    a. Provided in corridors
2. Round 15" single face
    a. Provided at the following locations:
        i. Gymnasium (provide with wire guard)
        ii. Cafeteria
        iii. Dining Area
        iv. Library
        v. Rooms over 2500 sq. ft.

3. 12-hour dial
4. Quick correction for time changes (maximum of 5 minutes)
5. Steel or ABS case; black finish
6. UL and cUL listed
7. Mounts to a standard-sized gang box
8. No external screws visible on the bezel or housing

E. Provide with appropriate mounting accessories, which may vary by location. Include a dual-sided clock mount where indicated on the plans.

2.05 Digital Secondary Clocks (Secondary Schools)

A. Provide clocks at all locations indicated on the technology plans. Digital clocks are designated with a subscript “D” and a number to indicate single (“1”) or double-sided (“2”).

B. Clock technologies:

1. Wireless with 24V distributed power
2. Wi-Fi network-based with 24V distributed power
3. Wired (2-Wire or Sync-Wire) with 24V distributed power
4. IP network-based with Power over Ethernet (PoE)

C. All clocks shall have built-in self-diagnostics and be configured for email alerts when there are the following errors:

1. NTP synchronization timeouts
2. Power resets

D. Clock requirements

1. 4”H digits
2. Multiple LED color options including Red, Green, White, and Amber
3. 4-digit display (00:00)
4. 12- or 24-hour display (adjustable/configurable)
5. Immediate correction for time change
6. Adjustable brightness settings
7. UL and cUL listed
8. Mounts to a standard-sized gang box
9. No external screws visible on the bezel or housing

E. Provide double- ided clocks in Corridors.

F. Provide single Sided clock in the following locations:

1. Gymnasium (provide with wire guard)
2. Cafeteria
3. Dining Area
4. Library
5. Rooms over 2500 sq. ft.

G. Provide with appropriate mounting accessories, which may vary by location. Include a dual-sided clock mount where indicated on the plans.

H. Verify with Owner the desired color of LEDs.

2.06 Wire Guard

A. In spaces where the clock needs additional protection to avoid damage, provide a clear polycarbonate guard/cover.

B. Applies to gymnasiums and anywhere else that the clock is likely to be hit.

Part 3 - Execution

3.01 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.02 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in four (4) three (3) hour sessions for administration and management of the systems.
2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance personnel.
3. Provide printed training materials for each trainee, including product manuals, course outline, workbook and student guides.
4. Provide hands-on training with operational equipment.
5. Training shall be oriented to the specific systems being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.03 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.04 Secondary Clocks

A. Clocks shall be configured to receive time data from an NTP or SNTP server or from a master clock.

B. Contractor shall confirm preferred configuration with Owner during installation.

C. Contractor shall add up to ten (10) NTP sources of the Owner's choosing.

D. Contractor shall configure email alerts for errors/failures and confirm with Owner the email address(es) to receive these alerts.

End of Section

Section 27 60 00 – Physical Security General Requirements

Part 1 - General

1.01 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance, Electronic Access Control, Intrusion Detection, and their sub systems.

C. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.

D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

E. Contractor shall be, or Contractor shall provide, an Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.

F. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

G. Full system functionality must be maintained during additions and renovations in unaffected areas.

H. FBISD Police Department / Life Safety Department shall be consulted on every project.

I. Remove and disconnect abandoned security equipment. Remove any abandoned cabling above ceilings and patch all penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 51 00 – Distributed Communications Systems

I. Section 27 62 00 – Electronic Access Control System

J. Section 27 64 00 – Video Surveillance System

K. Section 27 66 00 – Intrusion Detection System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Minimum of 5 years experience in security industry.

C. Certified by manufacturer for sales and service of equipment.

D. Provide 24 hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours.

E. Licensed in the State of Texas

F. Contractor shall pay for all applicable permits.

G. 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.

H. Submittal: Certification shall be submitted with physical security system(s) submittals.

1.06 Pre-Construction Procedures

A. Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to the system.

1.07 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:

1. Server(s) processor(s), disk space and memory size
2. Workstation(s) processor(s), disk space and memory size
3. Operating System(s) Software, where software is provided or upgraded
4. Application Software, with Optional and Custom Software Modules supplied in this project
5. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.
6. Network reliability requirements
7. Number and location of LAN ports required
8. Number of IP addresses required.
9. Other specific network requirements, preferences, and constraints
10. Backup/archive system size and configuration
11. Start-up operations
12. Description of site (field) control equipment (Controllers/Field Panels) and their configuration
13. Access control power calculations.
14. Battery backup requirements

1.08 General requirements

A. Security cabling

1. All security system cabling shall be orange in color.
2. All security system cabling shall be plenum rated, unless installed in a wet or exterior environment. Cable shall be rated for the environment in which it is installed in.
3. All security system cabling shall be installed following the same pathway and support requirements as the Division 27 Communications.
4. If a wire basket tray is not present, then J-hooks shall be provided throughout the entire pathways.
5. No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.

1.09 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.10 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

D. As built drawings for the security systems must include model number, serial number and installed location for each security device (i.e., camera, card reader, motion detector, etc.)

1. As-built drawings shall clearly identify all separate arming zones.

a. Example: Each detection device shall be home run to a dedicated zone. Each zone shall be on a floor plan with zone number, device type, device location. Keypad, main panel, zone expanders shall also be identified on the map. This will assist in troubleshooting faults or alarm.

b. Contractor shall provide (2) 11” x 17” laminated drawings of Intrusion System Zone map. Contractor shall turn over to FBISD Life safety Manager.

c. Contractor shall provide (1) 30” x 42” laminated drawings of Intrusion System Panel wiring diagram for each panel. Contractor shall turn over to FBISD Life Safety Manager.

E. 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. Include this requirement for all Division 28 systems.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Grounding and Bonding

A. The Contractor shall bond and ground the primary protectors and the metallic member of cable sheaths to building ground utilizing a minimum of 14-awg and no greater then 6-awg at the closest point of entrance as practical, not exceeding 50 feet, in accordance with the NEC.

2.03 Refer to individual sections for additional product information.

2.04 Fire Stopping Materials

A. Refer to Section 27 00 00 for additional requirements.

Part 3 - Execution

3.01 Network Time Protocol (NTP) Synchronization

A. All security systems as well as additional integrated systems such as intercom/PA, SQL/database servers and data logging servers shall synchronize to a common NTP server.

B. All systems including servers and workstations shall be within 250ms of each other or less depending on specific system requirements. The synchronization frequency shall be no less than every 1 hour.

C. The Contractor shall coordinate with the Owner for a NTP server connection address.

3.02 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.03 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide for (4) hours of training for two (2) persons on each system.

C. Training shall be conducted on-site with a manufacturer’s representative.

D. After training and FBISD review of the system, Contractor may be required to readjust camera angles which will be included in the base costs.

E. Training / demonstration shall provide for a “user’s manual” written specifically for the school personnel onsite, for daily routine operations of the systems. On-Site Training

1. General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.

2. Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.

    a. Provide professional video and audio recording of each software screen option with Owner approval of content.

    b. Provide end user video recording for all training levels.

3. Training shall comprise two separate levels of training;

    a. User Group upon substantial completion of the project.

        i. User group training shall include a site/building walk through indicating locations of equipment and their usage.

        ii. User group training shall include the operation of workstation capability of system monitoring, command override and report generation.

    b. Maintenance Group upon completion of the project prior to close out.

        i. Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.

        ii. Review of a-build documentation at each controller location.

        iii. Troubleshooting techniques in hardware and software.

4. The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.

F. Duration: Refer to the individual sections for the minimum time requirements.

3.04 Warranty

A. Refer to Section 27 00 00 for additional requirements.

B. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.

C. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the field hardware or computers and are purchased directly from the manufacturer.

D. Purpose

1. The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.

2. The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

3.05 Examination of Site and Documents

A. Bidder shall examine all documents, shall visit the site(s) prior to submitting proposal, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the proposal process.

B. Verify cable lengths comply with published standards.

C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner/Consultant regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Failure to make the examination shall not result in any Change Order requests.

G. The Bidder shall base the proposal on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the proposal form requires.

H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.

I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

3.06 Installation Requirements

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.

C. All cabling shall be installed in accordance with Div. 27 installation standards,

1. An RCDD will review and approve ALL Div. 28 cabling installation. The installing contractor shall be responsible for contracting with and RCDD if the installing company does NOT have and RCDD on staff.
2. All cabling installed in exposed areas shall be in conduit,
3. All cabling shall be rated for the space that is installed in

D. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

E. Beginning installation means Contractor accepts existing conditions.

F. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.

G. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

H. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

I. All wiring shall be run "free-air," in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.

J. Avoid abrasion and other damage to cables during installation.

K. The cable system will be tested and documented upon completion of the installation as defined in the section below.

L. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as indicated in their published literature, unless specifically noted herein to the contrary.

3.07 Cooperation

A. The Contractor shall cooperate with Consultant's and Owner's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.08 Commissioning Submittals

A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.

1. Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.

2. Software: One set of fully functional software in manufacturer's original media packaging, temporarily licensed for a 30-day evaluation period.

3. Web-based Training: Access to web-based training modules.

3.09 Commissioning

A. Provide programming and commissioning for each system as described in individual sections below.

B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and commissioning.

C. The security Contractor is required to place entire system into full and proper operation as designed and specified.

D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

E. Verify that all system software is installed, configured, and complies with specified functional requirements.

F. Perform final acceptance testing in the presence of Owner's representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.

1. Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.

2. Conduct final acceptance tests in presence of Owner's representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

3. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

4. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.10 Operation and Maintenance Manuals

A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:

1. Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2010 files, in ".dwg" format, on CD or DVD disks.

2. Manuals: Submit two (2) copies of each of the following materials in bound manuals, or electronic PDF copies, with labeled dividers:

a. A final Bill of Material for each system

b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.

c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.

e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.

B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2010 editable .dwg format of the reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals to the Owner, on CD or DVD disks.

1. Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.

2. In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.

3. The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on CD or DVD disks.

C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

3.11 Closeout Procedures

A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Prior to substantial completion, the security camera contractor shall submit a detailed spreadsheet showing camera numbers, room area of viewing and IP addresses to district for their use.

C. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

D. As built drawings for the security systems must include model number, serial number and installed location for each security device (i.e., camera, card reader, motion detector, etc.)

1. As-built drawings shall clearly identify all separate arming zones.

a. Example: Each detection device shall be home run to a dedicated zone. Each zone shall be on a floor plan with zone number, device type, device location. Keypad, main panel, zone expanders shall also be identified on the map. This will assist in troubleshooting faults or alarm.

b. Contractor shall provide (2) 11” x 17” laminated drawings of Intrusion System Zone map. Contractor shall turn over to FBISD Life safety Manager.

c. Contractor shall provide (1) 30” x 42” laminated drawings of Intrusion System Panel wiring diagram for each panel. Contractor shall turn over to FBISD Life Safety Manager.

E. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.

F. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the

Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.

G. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

H. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.

I. The system has successfully completed a 30-day performance period.

J. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

End of Section

Section 27 62 00 – Electronic Access Control System

Part 1 - General

1.01 Scope

A. This specification section covers the furnishing and installation of a new and complete, low-voltage, Electronic Access Control System (EACS) as shown on construction drawings.

B. Contractor shall furnish and install access control hardware devices, mounting brackets, power supplies, switches, controls, consoles and other components of the system as required.

C. Contractor shall furnish and install access control related software to allow this system expansion. Software includes required license addition for access control readers and electrified portals, workstations and required physical security system Integration.

D. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

E. Full system functionality must be maintained during additions and renovations in unaffected areas.

F. Remove and disconnect abandoned security equipment. Remove any abandoned cabling above ceilings and patch all penetrations. All removed equipment shall be returned to FBISD unless otherwise directed by the FBISD project manager.

G. Refer to Section 27 00 00 for additional project scope information.

1.02 Precedence

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.03 Related Work

A. Division 08 - Door Hardware

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 05 28 – Pathways for Technology Systems

F. Section 27 05 37 – Firestopping for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 51 00 – Distributed Communications Systems

J. Section 27 60 00 – Physical Security General Requirements

K. Section 27 64 00 – Video Surveillance System

L. Section 27 66 00 – Intrusion Detection System

1.04 Definitions

A. ACS – Access Control System

B. IDS – Intrusion Detection System

C. VMS – Video Management System

D. Refer to Section 27 00 00 for additional definitions.

1.05 Reference Standards and Codes

A. IEC 60839-11-5:2020 - Open Supervised Device Protocol (OSDP)

B. Refer to Section 27 00 00 for additional requirements.

1.06 Qualifications

A. Lock installers for fire rated doors are to be trained and certified by the manufacturer via Intertek Qualified Personnel (IQP) Raceway and Hardware Installer Program on the proper installation and adjustment of fire, life safety, and security products in compliance with NFPA 80 including: hanging devices; locking devices; closing devices; and seals.

1. Trained and qualified raceway installers are required to ensure modifications do not affect the integrity of fire doors. Doors must remain compliant with NFPA 80.

B. Refer to Section 27 00 00 for additional requirements.

1.07 Pre-Construction Submittals

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

D. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

d. Hardware Layouts: Include individual panel layouts, showing the number of controllers, sub-panels, and other associated devices per location.

e. Power Calculations: Include the anticipated power loads, number and type of power supplies including all power supply boards, number of 120VAC circuits required, battery backup including the quantities of batteries to meet requirements, PoE loads, fire alarm connection requirements, etc.

1.08 Pre-Installation Procedures

A. Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a

demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to the system.

B. For in-use, existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses, passwords and pre-build out all the enclosures including the interconnects within the enclosure prior to being delivered to the project or installed.

C. The Contractor shall cable all controlled or monitored doors, intercoms, etc. and terminate this cable in the access control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices such as door hardware, card readers, intercoms, etc.

D. The Contractor shall program the access control system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, associated door hardware and full system functionality can be tested. Programming shall include all doors, associated inputs, outputs, and interoperability regardless of final field device status.

E. The Contractor shall perform final connections and testing onsite when field devices such as electrified door hardware has been installed.

F. Refer to section 27 00 00 and 28 00 00 for additional requirements.

1.09 General requirements

A. Access Control manufacturer:

1. Win DSX
2. Or FBISD approved equal

B. The Basis of Design for the access control system shall be:

1. Intelligent 2 Door Package NV (Nonvolatile Memory) Processor DSX-1042PKGNV
2. Intelligent 8 Door Package DSX-1048PKG
3. Intelligent 2 Door Controller Package DSX-1042PKG
4. Two Door Controller DSX-1042
5. Power Distribution Panel DSX-1040PDP
6. 24V Lock Power Supply SP320-27
7. ThinLine II Low Profile Proximity Card Reader DSXID-TL5395
8. Latching Hold-up Switch HUSK20
9. Hold-up Button Momentary Panic HUB-2SA

10. Door position sensor shall monitor door status Amseco AMS-25B-G

C. Provide electric panic devices (quiet electric latch retraction) on all exterior doors with a card reader so loss of power will not leave doors unsecured.

D. Locks on interior security vestibule doors shall fail open in the event of a loss of power or in the event of a fire alarm.

E. Provide card readers at the following locations, final locations to be reviewed with FBISD Life Safety and Police Department and FBISD Design Manager:

1. Exterior Kitchen Entrance
2. Front Entrance to Building
3. Security Vestibule Doors
4. Nearest entrance to Staff Parking Lot
5. Nearest Entrance to Bus Loading Area
6. MDF and IDF Rooms
7. All Exterior Doors
8. At Administration Area – On Main Door Leading to Main Corridor and Lobby
9. Records Room
10. Testing Materials Room
11. Satellite buildings doors shall be coordinated with the Owner during the design process to verify which doors, if any, will require access control.
12. Pedestrian / Vehicle gates shall be coordinated with the Owner during the design process to verify which gates, if any, will require access control.

F. Provide door position sensors on all doors with card readers.

G. Provide a “secondary” student access point at all secondary schools

1.10 Construction Progress Submittals

A. Refer to Section 27 00 00 requirements.

1.11 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Electronic Access Control Hardware

A. The Access Control Panel (ACP) is used as the subcomponent to the security management system for the purpose of initiating all decision-making criteria as it relates to the cardholders, readers, and associated hardware connected. Decisions are made by the ACP and uploaded to the host computer as historical events.

B. The ACP shall be listed for Underwriters Laboratory (UL):

1. UL294 (Access Control System)

C. Provide an access control system based off of WIN DSX hardware and interface modules. The panels shall:

1. Operate without the need for the host to be on-line. No decisions shall be dependent on the host.
2. Support on-board 10/100 Ethernet communications to the host as primary communication.
3. Include a request-to-exit and door status contact input for each reader without the need for additional modules for future use.
4. Detect “forced entry” and “door left open.” A separate action is required for each.
5. Allow mapping of readers to any output address within the same controller.
6. Support at least 50 user-selected holidays.
7. Allow all unused door logic, such as door strike relays, request-to-exit inputs, and door status inputs to be assigned as general-purpose points.
8. Support optional modules for additional customization of inputs and outputs.
9. Wireless intelligent lock support.
10. Wired intelligent lock support.
11. Elevator support.
12. Maintain historical information for a minimum of three (3) months without AC power.
13. Automatically adjust for daylight savings time and leap year.
14. Support a variety of reader technologies.

15. Support the following card/reader technologies as a minimum:
    a. Magnetic Stripe
    b. 125KHz Proximity cards
    c. 13.56Mhz Smart Cards and technologies
16. Maintain the expiration date for each cardholder. Once the date is reached, the card will automatically be disabled. No access shall be authorized.
17. Maintain three (3) access times for each door location: Standard, Long, and Egress.
18. Have the ability to maintain an automatic door unlock during specific hours and days.
19. Support a minimum of (2) “levels” of Anti-Passback: Global and Area.
20. All controllers and expansion modules shall have the latest ACS recommended firmware installed and shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.
21. The Contractor shall provide adequate number of access control panels, controllers, door interface panels and I/O panels for a complete turnkey system to support all components as indicated on project drawings, specifications and as required.
22. Basis of design is MP1502 controllers, MR52-S3 interface panels and MR16IN-S3/OUT-S3 I/O panels.
23. MP1501 Single door controllers shall only be used when specifically specified or approved by the Consultant.
24. MR50 single door expansion modules shall only be used when specifically specified or approved by the Consultant.
25. For RS-485 based intelligent lock installations, expansion module star topologies, or complex installations requiring significant RS-485 connection the Contractor shall utilize Mercury Security MUX8 RS-485 multiplexers.
26. Mercury Security Series-3 MP1501 Controller:
    a. Power Input:
        i. PoE or PoE+
        ii. Direct current (12VDC) ±10% 1800 mA maximum.
    b. Power Output:
        i. PoE powered - 12 Volts DC at 625mA including reader and AUX output.

ii. PoE+ or 12 VDC powered - 12 Volts DC at 1250mA including reader and AUX output.

c. Reader Interface: 12VDC ±10%. PTC limited to 300mA maximum per reader.

d. Inputs: two general purpose programmable circuit type and dedicated tamper.

e. Outputs: two relays – Form-C, 2 Amp, 30 volts direct current

f. Onboard Reader Ports: Supports 2 readers on up to 1 opening.

g. RS-485 Bus: (1) RS-485 bus.

h. OSDP Secure Channel support.

i. LED: TTL, two wire or one wire bi-color support

j. Buzzer: One-wire LED mode.

k. Supports up to 1 OSDP reader nativity or up to 16 readers with downstream modules.

l. Supports up to 130 inputs and 130 outputs with downstream modules.

m. 240,000 card holder capacity.

n. Dimensions: 5.5”W x 2.75”H x 1.33”D with bracket. Fits within a 3-gang box.

o. Provide with Mercury Security Series-3 MR52 or other SIO modules as necessary for the application when Mercury controllers are utilized.

p. Provide with an appropriate, lockable enclosure to house the controller as well as the terminations and any expansion modules.

27. Mercury Security Series-3 MP1502 Controller:

a. Power Input

i. Direct current (12-24VDC) ±10% 500 mA maximum.

b. Power Output: 12 Volts DC at 650mA including reader and AUX output.

c. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

d. Inputs: Eight general purpose programmable circuit type and dedicated tamper.

e. Outputs: Four relays – Form-C, 2 Amp, 30 volts direct current

f. Onboard Reader Ports: Supports 4 readers on up to 2 openings.

g. RS-485 Bus: (1) RS-485 bus.

h. OSDP Secure Channel support.

i. LED: TTL, two wire or one wire bi-color support

j. Buzzer: One-wire LED mode

k. Supports up to 128 OSDP readers on up to 64 openings with downstream modules.

l. Supports up to 520 inputs and 516 outputs with downstream modules.

m. 240,000 card holder capacity.

n. 2gb to 8gb MicroSD card support.

o. Dimensions: 8”W x 6”H x 1”D.

p. Provide with Mercury Security Series-3 MR52 or other SIO modules as necessary for the application when Mercury controllers are utilized.

q. Provide with an appropriate, lockable enclosure to house the controller as well as the terminations and any expansion modules.

28. Mercury Security Series-3 MP2500 Controller:

    a. Power Input

        i. Direct current (12-24VDC) ±10% 500 mA maximum.

    b. Inputs: None.

    c. Outputs: None

    d. Onboard Reader Ports: None.

    e. RS-485 Bus: (2) RS-485 buses.

    f. OSDP Secure Channel support.

    g. Supports up to 128 OSDP readers on up to 64 openings with downstream modules.

    h. Supports up to 1024 inputs and 1024 outputs with downstream modules.

    i. 600,000 card holder capacity.

    j. 2gb to 8gb MicroSD card support.

    k. Dimensions: 5”W x 6”H x 1”D.

    l. Provide with Mercury Security Series-3 MR52 or other SIO modules as necessary for the application when Mercury controllers are utilized.

    m. Provide with an appropriate, lockable enclosure to house the controller as well as the terminations and any expansion modules.

29. Mercury Security Series-3 MP4502 Controller:

    a. Power Input

        i. Direct current (12-24VDC) ±10% 550 mA maximum.

b. Power Output: 12 Volts DC at 650mA including reader and AUX output.

c. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

d. Inputs: Eight general purpose programmable circuit type and dedicated tamper.

e. Outputs: Four relays – Form-C, 2 Amp, 30 volts direct current

f. Onboard Reader Ports: Supports 4 readers on up to 2 openings.

g. RS-485 Bus: (2) RS-485 buses.

h. OSDP Secure Channel support.

i. LED: TTL, two wire or one wire bi-color support

j. Buzzer: One-wire LED mode

k. Supports up to 128 OSDP readers on up to 64 openings with downstream modules.

l. Supports up to 1024 inputs and 1024 outputs with downstream modules.

m. 2,000,000 card holder capacity.

n. FICAM high-assurance credential authentication such as FIPS 201 HID pivCLASS.

o. BACnet IP communication protocol compatible.

p. Embedded elevator destination dispatch capabilities.

q. 3rd party extended application support.

r. 2gb to 8gb MicroSD card support.

s. Dimensions: 8”W x 6”H x 1”D.

t. Provide with Mercury Security Series-3 MR52 or other SIO modules as necessary for the application when Mercury controllers are utilized.

u. Provide with an appropriate, lockable enclosure to house the controller as well as the terminations and any expansion modules.

30. Mercury Security Series-3 MR53-S3 Reader Expansion Module:

    a. Power Input

        i. Direct current (12-24VDC) ±10% 500 mA maximum.

    b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

    c. Inputs: Eight general purpose programmable circuit type and dedicated tamper.

d. Outputs: Six relays – Form-C, 2 Amp, 30 volts direct current

e. Onboard Reader Ports: Supports 4 readers on up to 2 openings.

f. Host Communication: RS-485

g. OSDP Secure Channel support.

h. LED: TTL, two wire or one wire bi-color support

i. Buzzer: One-wire LED mode

j. Dimensions: 6”W x 8”H x 1”D.

31. Mercury Security Series-3 MR16IN-S3 Input Expansion Module:

    a. Power Input

        i. Direct current (12-24VDC) ±10% 350 mA maximum.

    b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

    c. Inputs: Sixteen general purpose programmable circuit type and dedicated tamper.

    d. Outputs: Two relays – Form-C, 2 Amp, 30 volts direct current

    e. Onboard Reader Ports: None.

    f. Host Communication: RS-485

    g. Dimensions: 6”W x 8”H x 1”D.

32. Mercury Security Series-3 MR16OUT-S3 Output Expansion Module:

    a. Power Input

        i. Direct current (12-24VDC) ±10% 1100 mA maximum.

    b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

    c. Inputs: Two general purpose programmable circuit type and dedicated tamper.

    d. Outputs: Sixteen relays – Form-C, 2 Amp, 30 volts direct current

    e. Onboard Reader Ports: None.

    f. Host Communication: RS-485

    g. Dimensions: 6”W x 8”H x 1”D.

33. Mercury Security MUX8 RS-485 Multiplexer

    a. Power Input

        i. Direct current (12-24VDC) ±10% 350 mA maximum.

b. Interface Ports: (1) RS-485 input and (8) 2-wire RS-485 outputs, bi-directional.

c. Host Communication: RS-485

d. Dimensions: 5”W x 6”H x 1”D.

D. Genetec Synergis Cloud Link Controller

1. The Contractor shall furnish and install a minimum of (1) Synergis Cloudlink per facility. Provide additional as required.
2. Intelligent controller with current support for HID controllers/interfaces, Mercury EP/LP controllers, Axis controllers, Assa Abloy PoE and wireless locks, Schlage AD locks and Salto Sallis wireless locks.
3. (2) gigabit Ethernet ports.
    a. PoE+ support on (1) Ethernet port.
4. 9-16 VDC auxiliary/backup power input.
5. (4) RS-485 ports with OSDP support, expandable to (12).
6. Supports up to a total of 256 readers/electronic locks. Refer to manufacturer documentation for specific device type quantities and furnish and install the quantity of Cloudlinks required to support the total device count.
7. Peer-to-peer communication with other Cloudlinks.
8. Global I/O with other Cloudlinks.
9. Supports threat level management.
10. (3) onboard auxiliary inputs for tamper, AC fail, etc.
11. Encrypted communication.
12. Support for 250,000 card holders and 150,000 offline events.
13. Full off line operation with decision making capabilities.
14. Built-in webserver for configuration.
15. UL 294 listed.
16. Dimensions: 6.89”L x 4.22”W
17. 2-year warranty.
18. No substitutions.

2.03 ACS Web Client

A. The web client shall be a true HTML5 thin client with no download required.

B. The Contractor shall provide any mobile web servers and licenses required to support this functionality.

C. The web client shall support the latest versions of the following browsers:

1. Microsoft Edge
2. Google Chrome
3. Mozilla Firefox
4. Apple Safari

D. The web client shall support Microsoft Active Directory integration.

E. The system shall be capable of a minimum ## concurrent web users.

2.04 ACS Health Monitor

A. The Contractor shall provide, install and configure health monitoring software to be installed on each server running the ACS or a service required for the ACS operation like a SQL server.

B. The Server Monitoring Service shall be a Windows service that automatically launches at system startup, irrespective of whether a user is logged in not.

C. The health monitoring software should be installed on a server that is not the directory management server.

D. The health monitoring service shall notify the system administrators of any problem or maintenance required.

E. Health events shall be able to create SNMP strings.

2.05 Mapping Software

A. The ACS software shall be provided with native integrated mapping software.

B. The mapping software shall be compatible with PDF, JPEG and PNG.

C. The Contractor shall license real time satellite maps.

D. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.

E. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.

A.

F. The Contractor shall obtain the building plans for their use.

2.06 Contactless 13.56 MHz Smart Card and 125 KHz Legacy Card Multiclass Readers

125Khz and 13.56Mhz MultiClass readers

Supported Credentials.

a. ThinLine II Low Profile Proximity Card Reader DSXID-TL5395.

b. Able to read 37-bit card format support with no facility code.

c. 125 KHz proximity.

1.

2. OSDP V2 enabled. Wiegand shall not be used.

a. The Contractor shall supply with (2) 120 Ohm end of line resistors for controller side and final reader side of the OSDP bus.

Operating voltage range: 5-28 VDC

Current draw: 45mA average and 100mA peak @ 24VDC.

3. Color: Black

4. IP 55 exterior rated.

5.

6. With attached pigtail

7. Provide adapter plate to mount on a single-gang mud ring as required.

8. Firmware upgradable and configurations via mobile app.

9.

10. Provide the ability to transmit an alarm signal via an integrated optical tamper switch if an attempt is made to remove the reader.

11. An audio beeper and RGB light bar shall provide various tone and light sequences to signify: access granted, access denied, power up, and diagnostics.

12. Manufacturer:

a. WIN DSX

2.07 Surge Protection for Wiegand Communication

A. The Contractor shall provide a surge protector for all exterior card readers not directly attached to a building which would include any pedestal mounted reader, gate reader or any other exposed reader potentially prone to surges.

B. Mount unit outside of the access control/power supply panels. Provide with appropriate mounting and enclosures as required.

C. There shall be a minimum of a 36” shielded cable from the surge protector to the device to allow for adequate clamping time.

D. When protector is mounted in interior, dry or weather sealed enclosure:

1. Nominal voltage rating of 12V AC/DC. Provide correct module per required voltage level if different from 12V.

2. 20,000A surge current rating.

3. Protects 2-pair per module.
4. Accepts up to 10AWG cable
5. Connect directly to ground.
6. UL 497B listed
7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
    a. Ditek DTK-2MB Mounting Base
    b. (2) Ditek DTK-2MHLP12B Surge Modules
    c. Or approved equal

2.08 Surge Protection for 120 VAC power

A. The Contractor shall provide a surge protector for all 120VAC supplied panels and enclosure when there is a critical risk of surges. This does not include interior panels which only serve interior devices or devices connected directly to a building where the risks of surges are negligible.

B. There shall be a minimum of a 36” of cable from the surge protector to the load to allow for adequate clamping time.

C. Exterior, enclosure or other mounted:

1. Nominal voltage rating of 120VAC, single-phase, 20A continuous load.
2. Parallel connected.
3. 50,000 A surge current rating.
4. UL 1449 Type 1 SPD listed
5. LED indicator.
6. NEMA 4X rated.
7. Maintain a minimum of 3’ of cable from the surge protector to the load.
8. Manufacturer:
    a. Ditek DTK-120HW
    b. Or approved equal

D. Interior, wall mount:

1. Nominal voltage rating of 120VAC, single-phase, 20A continuous load.
2. Series connected.

3. 54,000 A surge current rating.
4. 35db of EMI/RFI filtering.
5. UL 1449 Type 2 SPD listed
6. UL 1289 EMI/RFI Noise Filtering listed.
7. LED indicator.
8. Form C dry contacts for remote monitoring.
9. Include with NEMA 4X enclosure.
10. Maintain a minimum of 3’ of cable from the surge protector to the load.
11. Manufacturer:
    a. Ditek DTK-TSS4D
    b. Or approved equal

2.09 Power Supplies and Access Control Enclosures

A. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.

B. Enclosures

1. Wall mountable.
2. Include a cam-lock and tamper switch.
3. Include with rocker switches to control power to the power supplies.
4. DSXZ 8 door enclosures
    a. Color: Black
    b. Manufacturer: WIN DSX

C. Power Supplies

1. 115 VAC input
2. 12VDC or 24VDC selectable outputs at:
    a. 4 amp continuous power @ 12VDC or 24VDC.
    b. 6 amp continuous power @ 12VDC or 24VDC.
    c. 10 amp continuous power @ 24VDC.
3. High capacity battery charging circuit.

4. Form “C” supervision contacts for AC Low, AC Fail, and battery presence.
5. Supervised Fire Disconnect.
6. Low power Disconnect.
7. Class 2 aux. output.
8. UL 294 listed sub-assembly for access control.
9. Furnish and install with power rocker switches for each power supply.

D. Batteries

1. The Contractor shall provide a minimum of (2) 12V, 7ah, sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per 24VDC power supply and (1) 12V, 7ah per 12VDC power supply.
2. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.
3. Manufacturer:
    a. Interstate Power Patrol FAS1075
    b. Power Sonic PS-1270
    c. Or approved equal

E. Sub-Assemblies

1. The Contractor shall provide all sub-assemblies to meet the project requirements
2. Access Control Module
    a. Independently controlled fused protected outputs:
        i. Fail-Safe and/or Fail-Secure power outputs.
        ii. Dry form “C” 5 amp rated relay outputs (fused).
        iii. Any combination of the above
3. Access Control System trigger inputs:
    a. Normally open (NO) inputs.
    b. Open collector sink inputs.
    c. Any combination of the above.
4. Multi-Output Power Distribution Module
    a. Single input distributed over eight (8) outputs.
    b. Fused protected outputs.

c. Output terminals shall accommodate up to 12AWG wires.

5. Multi-Output Power Distribution Module with Dual Inputs
    a. Two (2) inputs distributed over eight (8) outputs.
    b. Outputs shall be configurable by input.
    c. Fused protected outputs.
    d. Output terminals shall accommodate up to 12AWG wires.
6. Voltage Regulator
    a. The Contractor shall provide a voltage regulator to provide constant 5VDC or 12VDC outputs for access control boards, modules or other applicable components as well as a voltage regulator for door hardwiring or controllers requiring 12VDC.
    b. 24vdc Input.
    c. Selectable 5 or 12VDC output.
    d. Output rating of 6amp max.
    e. Stackable with both Networkable and dual input power distribution modules for space savings.
7. Power supplies and sub-assemblies shall be manufactured by WIN DSX or FBISD approved equal.
    a. eflow4NB - 4amp 12vdc/24vdc power supply (UL listed Sub-assembly).
    b. eFlow6NB - 6amp 12vdc/24vdc power supply (UL listed Sub-assembly).
    c. eFlow104NB - 10amp 24vdc power supply (UL listed Sub-assembly).
    d. ACM8 - Eight (8) output, fused Access Control Module (UL listed Sub-assembly).
    e. ACMS8 – Dual input, eight (8) output, fused Access Control Module (UL listed Sub-assembly).
    f. Linq2 - Network Communication Module (UL listed Sub-assembly).
    g. Linq8PD - Dual input, eight (8) output, fused Network Communication Module (UL listed Sub-assembly).
    h. PDS8 - Dual input, eight (8) output, fused power distribution module (UL listed Sub-assembly).
    i. VR6 - Voltage Regulator (UL listed Sub-assembly).
    j. RSB2 – Rocker switches with mounting bracket.

2.10 Power Supplies and Access Control Enclosures

A. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.

B. All power supplies and their supporting infrastructure shall be mounted to fire rated with rating exposed, ¾" plywood secured to the wall. The Security Contractor shall furnish and install this plywood behind all enclosures.

C. All power supplies shall be hardwired by a licensed electrician with 120VAC power on a dedicated circuit.

D. All enclosures shall be bonded to building ground.

E. Enclosures

1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures access control controller boards when required.

2. Internal components pre-wired at manufacturer including connectors for Mercury panels.

3. Wall mountable.

4. Include a cam-lock and tamper switch. Connect tamper switch to tamper input on access control panel and label as panel door.

5. The following architecture shall be utilized:

    a. WIN DSX 8-door enclosure with power supply enclosure.

6. Include with Panduit finger duct wire management and Velcro straps for pre-installed cable.

7. Manufacturer:

    i. WIN DSX

F. Power Supplies

1. 120 VAC hardwired input

2. Foor all configurations, furnish FPO250 power supplies.

G. Batteries

1. The Contractor shall provide a minimum of (2) 12V, 7ah, sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per power supply.

2. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.

3. Manufacturer:
    a. Interstate Power Patrol FAS1075
    b. Power Sonic PS-1270
    c. Or approved equal

H. ACS Integration

1. Integration to access control system to allow monitoring through the Unified software application.
2. Integration shall include the ability to create custom events and actions based on events received from the power supplies network module.
3. Furnish and install all licensing required to integrate each network module from all power supplies.
4. Furnish and install licensing for up to (##) client workstations.

I. Monitoring Software

1. Software to centrally manage all network modules in the power supplies.
2. Critical event summaries
3. Email notifications
4. Preventative maintenance warnings from failing batteries, electronic locks, etc.
5. Manages network monitoring module firmware updates.
6. Permission based controls.
7. Manufacturer:
    a. LifeSafety Power MSM-Enterprise
    b. Include with (1) MSM25 25 pack license block

2.11 Voltage Regulator

A. The Contractor shall provide voltage regulators to convert from, 24 VAC/DC power to 12 VDC power where required such as remote card readers where voltage drop from 12VDC is too great.

B. Input: 24 VAC or 24 VDC

C. Output: 12VDC up to 3A continuous load.

D. Manufacturer:

1. Altronix VR5T
2. Or approved equal

2.12 Cabling

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. All cabling shall be Orange

C. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

D. UTP patch cables will be provided and installed by the Contractor in the IDF and provided and installed by Contractor at the control panels or at the door when required.

E. Wiegand cables for electronic access-controlled doors shall be a composite bundled cable and include the following cables and conductor counts:

1. Card reader, Wiegand – 6 conductor, 22 awg shielded.

2. Lock power – 4 conductor, 18 awg unshielded.

3. Door contact – 2 conductor, 22 awg unshielded. Furnish and install a second 22 awg, 2-conductor cable when the door contact connects to both the access control system and intrusion detection system.

4. Request to exit and/or latch detection/spare – 4 conductor, 22 awg unshielded

5. Manufacturer (Wiegand):

a. Belden (Wiegand) #658AFJ

b. General Cable (Wiegand) #4EPL1S

c. Superior Essex (Wiegand) #AC-A1x-68

d. West Penn #AC251822B

e. Or approved equal

2.13 Door Contacts/Door Position Switches (DC)

A. All doors with card readers and all doors shown for monitored only shall have a door position switch. When the door position switches are not shown in the Division 08 specifications, the security contractor shall furnish and install them. The Security Contractor shall be responsible for the connection of all door position devices to the access control system and other systems if sharing the same door position switch. Door position devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements.

B. Sealed and potted magnetic reed switch in contact housing.

C. Provide DPDT for applications with multiple security systems (Access Control/Intrusion Detection) utilizing a single door contact.

D. Door contacts shall be appropriately sized for any established holes within door frames.

E. Parts provided are basis of design. Determination of final part number is the responsibility of Contractor.

F. Provide color that matches door as close as possible.

G. Provide recessed switch whenever possible.

H. Provide armored whip for surface mount contacts.

I. Provide with a 1k/2k end of line (EoL) pre-built resistor pack. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

J. Provide GRI (George Risk Industries, Inc.) 180 Series for recessed applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

K. Provide GRI (George Risk Industries, Inc.) 4400 series for surface mount applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

L. Provide GRI (George Risk Industries, Inc.) MC-180 Series for hollow top channel applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

M. Provide GRI (George Risk Industries, Inc.) 4532 Series for overhead door applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

2.14 Request to Exit (REX) Devices

A. All doors with card readers shall have a request to exit with the exception of doors with a card reader in and a card reader out. When integrated request to exit devices are not shown in the Division 08 specifications, the security contractor shall furnish and install motion-based request to exit devices. The Security Contractor shall be

responsible for the connection of all requests to exit devices integral to the door, motion based or other to the access control system. Request to Exit devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements. Motion based Request to Exit devices shall only be used when not available in the door hardware.

B. Provide with a 1k/2k end of line (EoL) pre-built resistor pack when utilized to release doors with magnetic locks or other high security applications. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

C. Independent adjustable beam pattern.

D. Provide with mounting plate or wall mounting plate to mount over a single-gang backbox when required.

E. Provide white or black color that matches door as close as possible.

F. (2) Form C relay contacts each rated 1 A at 30 VAC or VDC for resistive loads.

G. DC Power draw: 39mA max @ 12 VDC.

H. Dimensions: 1.8”H x 6.75”W x 1.75”D.

I. Utilize contact closure REX hardware built into the handle or crashbar whenever possible.

J. Provide Bosch DS160/161

1. Provide with TP160/161 mounting plate when mounted over a backbox.

2. Or approved equals.

2.15 Electrified Hardware (EH)

A. The Security Contractor shall be responsible for the connection of all electrified hardware to the access control system. This shall include providing centralized power supplies located next to or integral to the access control panels. The Contractor shall coordinate with the door hardware specifications and schedules for additional information.

2.16 Door Release Button, Under Counter

A. SPDT, momentary push button

B. Guard ring around button to prevent accidental activation

C. Mount with button facing back of desk

D. Coordinate exact mounting location after deck or counter is fully complete and the sitting position has been decided.

E. Manufacturer:

1. Alarm Controls TS-18
2. Or approved equal

2.17 Key Switches

A. The Contractor shall furnish and install key switches at locations identified for the purpose of dogging and undogging electronically controlled doors.

B. DPDT, maintained, single direction

C. Satin stainless steel

D. Red and green LEDs

E. 24 VDC

F. Coordinate with Owner on keying

G. Furnish slim mullion style where required.

H. Manufacturer:

1. FBISD approved Product
2. .

2.18 Disconnecting Door Cord

A. The Contractor shall furnish and install disconnecting door cords for all removable mullions.

B. Polarized quick disconnecting plug

C. Integrated stress relief chain

D. Surface mountable

E. Manufacturer:

1. Honeywell Resideo 69 Disconnecting Door Cord

Part 3 - Execution

3.01 Physical Security Systems and Intercom Integration

A. Coordinate with FBISD for preferred integration method.

B. The electronic access control system shall be integrated with the video surveillance system and intrusion detection system.

1. The access control/intrusion detection interface shall be via an Ethernet interface. Contact closure integration shall only be utilized if the system is

existing and cannot be upgraded to Ethernet. The Contractor shall supply all necessary expansion boards if contact closure integration will be required.

2. The access control/video surveillance integration shall be via a native IP interface.

3. The video surveillance /intrusion detection interface shall be via an Ethernet interface.

C. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

D. The following minimum features shall be included in the integration; the following list is not all inclusive or exhaustive. The integration shall be a turnkey solution:

1. Call up live and/or recorded video from an alarm or event.

2. Graphical maps showing camera icons.

3. “Mouse over” camera viewing through the graphical maps.

4. Playback controls for recorded video.

5. Camera names brought in from the VMS.

6. PTZ camera mouse control.

7. Database entries for intrusion arm/disarm events on individual keypads.

8. Database entries for intrusion alarm events.

9. Graphical map symbols for intrusion keypads tied to camera views.

10. Intrusion devices or zones tied to camera views.

11. Alarm pop-ups and events shall include instructions and a sequence of operation to deal with events on the Intrusion Detection System, Video Management System and Electronic Access Control System.

12. Intercom pop-ups when call button is pressed with the ability to unlock the door.

13. Time syncing via common NTP server.

E. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

3.02 System Programming

A. The Contractor shall provide all programming necessary for a turnkey system.

B. Programming shall include but not limited to setting all required IP addressing, setting passwords, firmware upgrades, adding the devices into the software,

partitioning, area/zone creation, device naming, mapping, cross system integration, schedules, basic card holder groups, access levels, etc.

C. The Contractor shall be responsible for temporary schedules, card holder groups, access levels, etc required to make a building functional for certificate of occupancy requirements or basic facility use.

3.03 System Mapping

A. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

B. The maps shall have links to the other levels/sections as well as the global map.

C. Integrated cameras shall show their approximate field of view.

D. The floor plans shall include all access-controlled doors, controlled overhead doors and integrated devices.

E. Alarm icons for lockdown, panic and other alarms.

F. Contractor shall create toggles for IO control Including:

1. Lighting control

2. Water control

G. Contractor shall create interlock overrides on the maps for interlock door control.

H. Contractor shall create non-card reader doors for non-card reader door unlock and status monitoring.

I. Contractor shall create map entities for intercoms.

J. Contractor shall create Elevator control including:

1. Door Status

2. Door Control

3. Level Control

K. Contractor shall map integrated intrusion detection devices, areas and alarms.

3.04 System Partitioning, Zoning and Naming

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to control user access to certain areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor which includes naming at the administration/interface level in additional to the user facing interface.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as exterior, 1st floor, etc.

i. Device 1: Building name and floor/zone name - Door # or device name

ii. Device 2: Building name and floor/zone name - Door # or device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor/zone name - Door # or device name

ii. Device 2: Building name and floor/zone name - Door # or device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.05 Installation Procedures

A. The Contractor shall cable all controlled or monitored doors, intercoms, etc. and terminate this cable in the access control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices such as door hardware, card readers, intercoms, etc.

B. The Contractor shall program the access control system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, associated door hardware and full system functionality can be tested. Programming shall include all doors, associated inputs, outputs, and interoperability regardless of final field device status.

C. The Contractor shall perform final connections and testing onsite when field devices such as electrified door hardware has been installed.

3.06 Fire Alarm Interface

A. Certain electric locking mechanisms shall be connected (hardwired) to the building fire alarm system for fail safe release upon any fire alarm. A single low voltage/low current normally closed dry contact from the fire alarm system shall be provided by others in each room with Security Control Panels. This contact shall open on any fire alarm condition.

B. The access control system shall provide an output to the fire alarm system to release mag hold opens on alarm.

C. The fire alarm system shall provide an output to the access control system to trigger various rules and actions in the access control system.

D. All doors equipped with mag locks shall be connected to a fire alarm relay to release on fire alarm.

E. All doors secured with a card reader in and out shall be connected to a fire alarm relay to release on fire alarm.

F. The Contractor shall provide all additional UL listed failsafe relays and power supplies as necessary to interface to this contact and unlock all of these doors.

G. The Contractor shall verify fail safe and fail secure locking requirements with the Architect, door hardware contractor/provider and the AHJ.

3.07 End of Line Supervision

A. The Contractor shall furnish and install end-of-line resistors to provide end-of-line supervision on all access control input devices. This shall include but is not limited to door position switches, request to exit devices, door release buttons, and duress/panic buttons.

B. The Contractor shall furnish and install resistors as near to the field device as possible. Supervision resistance values shall be natively compatible with the associated control panel.

1. Mercury Security based installations shall utilize 1K resistors to provide a 1K / 2K ohm resistance values from associated inputs.

3.08 Passwords

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

3.09 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.10 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 6 hours of scheduled and dedicated training time in three (3) two (2) hour sessions for administration and investigation.

2. The Contractor shall provide up to 2 hours of dedicated training time for badge creation, printing and printer maintenance.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.11 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.12 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

F. Installation of locks on fire rated doors which require any modification or drilling of the door shall be done in accordance with the NFPA by a properly qualified and certified installer. The doors field WH-ETL labelling shall be properly updated.

3.13 Coordination

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, rule creation and coordination as requested by Owner or Consultant.

3.14 Aesthetics

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.15 Hardware Layout

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.16 Device Cabling/Wiring Installation Practices

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer’s rating.

L. No splices shall be installed in any cable.

3.17 Cable Termination

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.18 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.19 System Inspection

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

3.20 Labeling

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.21 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Door label/identifier

b. Location of each drop by orientation/permanent landmark in the room

c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.22 Pre-Check out

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The card readers are fully installed and functional.

3.23 Final Acceptance

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

3.24 Final Procedures

A. Perform final procedures in accordance with section 27 60 00.

End of Section

Section 27 64 00 – Video Surveillance System

Part 1 - General

1.01 Scope

A. This specification section covers the furnishing and installation of a new and complete, low-voltage, Video Management System (VMS).

B. Contractor shall furnish and install video surveillance hardware devices, mounting brackets, and other components of the system as required.

C. Contractor shall furnish and install all video management system related software to allow this system expansion. Software includes required licensing cameras, devices, workstations and required physical security system Integration.

D. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

E. Refer to Section 27 00 00 for additional project scope information.

1.02 Precedence

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.03 Related Work

A. Division 14 - General Elevator Requirements

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 05 28 – Pathways for Technology Systems

F. Section 27 05 37 – Firestopping for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 51 00 – Distributed Communications Systems

J. Section 27 60 00 – Physical Security General Requirements

K. Section 27 62 00 – Electronic Access Control System

L. Section 27 66 00 – Intrusion Detection System

1.04 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.05 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

1.06 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

1.07 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

D. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

E. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal

type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

d. Server Storage Calculations: Include each camera type, quantity, resolution, storage parameters, and storage duration, with the calculations showing the resulting server size or space requirements on an existing server.

1.08 Pre-installation Procedures

A. For in-use, existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses and secure passwords prior to being delivered to the project or installed. Confirm password with Owner and Consultant prior to setting them.

1.09 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.10 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.11 General Summary

A. System shall include IP cameras and a server based NVR with client stations and storage as described in this section and on the drawings.

B. The Category 6 cabling to each camera shall be provided by the structured cabling Contractor.

C. Patch cords for the IP cameras to the network switches shall be furnished by this Contractor and installed by the Contractor with participation by the Owner. Patch cords from the IP Camera to the data jack shall be furnished by this Contractor and installed by this Contractor.

D. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for the first year.

E. Contractor is responsible for meeting with Owner's representative at time of camera installation to verify exact placement and view of each camera to ensure coverage area is as intended.

1.12 Drawing Sheets

A. All cameras are designated with a C symbol on the project drawings. PTZ (Pan Tilt Zoom) cameras are designated with PTZ text next to the C symbol. Each camera has a corresponding label of the format "*#-##".

B. New cameras and Category 6 cabling shall be provided at each location with a label "N#-##."

C. New cameras and Category 6 cabling shall be provided to replace existing cameras and coaxial cable at each location with a label "E#-##". Rough-ins are to be reused whenever possible.

D. Existing cameras and cabling shall be demolished at each location with a label "D#-##". In these cases the Contractor shall patch and paint the holes in drywall or replace the ceiling tile. Ceiling tiles will be provided by the Owner.

1.13 Mounting and Installation

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where cameras shall be located. Plastic anchors are not allowed.

B. Wall mounted 180/360 degree or multi-sensor cameras shall be mounted horizontally on a wall arm, gooseneck, parapet, pendant or other similar method.

C. Exterior cameras shall be mounted on a wall arm/gooseneck.

D. Cameras mounted in droptile shall have a tile support bridge with a steel support cable connected to structure to prevent tile sagging, theft and vandalism. Utilizing toggle bolts or other screw in anchors is not allowed.

1.14 Code and Standard Requirements

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 VMS General Requirements

A. The VMS shall be based on the Video Insight system or FBISD design manager approved equal.

B. The VMS shall support video encoded in MPEG-4, MPEG-2, MJPEG, H.264, H.265/HEVC and Wavelet compression formats.

C. The VMS shall support audio encoded in g711 (u-law), g721, g723 or AAC compression formats.

D. The VMS shall be licensed for active directory.

E. The VMS shall synchronize to a common NTP server as the cameras and other security systems.

F. The system shall log all actions on a per user basis, all alarms and notifications on a per device basis and all errors and failures on a per device basis. These logs shall have the ability to be extracted to a document that can be emailed to an administrator.

G. The system shall support custom rules and actions.

H. The VMS shall be provided with mapping features. The Contractor shall acquire drawings from the Consultant to utilize for the mapping.

I. The VMS shall fully support H.264 and H.265/HEVC Smart Coding with dynamic GOP and Dynamic Frame Rate.

J. The VMS shall support full API level integration with all cameras utilized. Integrating via ONVIF is not acceptable.

K. The VMS shall have native API level support for fisheye cameras and client side dewarping. The VMS shall not utilize the video stream to detect a fisheye camera.

L. The system shall log all actions on a per user basis, all alarms and notifications on a per device basis and all errors and failures on a per device basis. These logs shall have the ability to be extracted to a document that can be emailed to an administrator.

M. The VMS shall be provided with a 5-year software maintenance service agreement to last through the duration of the project. The Owner shall be able to receive all major and minor software updates at no additional cost for the duration of the project. At the completion of the project the Owner shall have the option to receive a final software update to the latest version before the project is paid in full.

N. Manufacturer:

1. Video Insight

2. Or FBISD approved equal

2.03 VMS Web Client

A. The web client shall be a true thin client with no download required other than web browser plug-ins.

B. The Contractor shall provide any mobile web servers and licenses required to support this functionality.

C. The web client shall support the latest versions of the following browsers:

1. Microsoft Edge
2. Google Chrome
3. Mozilla Firefox
4. Apple Safari

D. The web client shall support Microsoft Active Directory integration.

E. The web client shall support the minimum following functionalities:

1. Live and recorded video playback.
2. Video export.
3. Multiple video tiles.
4. PTZ mouse controls.

F. The system shall be capable of a minimum of zzz concurrent web users.

2.04 Mapping Software

A. The VMS software shall be provided with native integrated mapping software.

B. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

C. The maps shall have links to the other levels/sections as well as the global map.

D. All cameras shall show their approximate field of view.

E. The cameras shall change state when motion is detected.

F. The floor plans shall include all access controlled door and integrated devices.

G. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.

H. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.

I. The Contractor shall obtain the building plans from the Consultant for their use.

2.05 Cameras and Devices

A. General:

1. All cameras and devices shall be time synced to the Owner's NTP server. Coordinate with the Owner to acquire the appropriate NTP address to use.
2. The contractor shall coordinate with the owner for IP addressing, network configuration, QoS and multicast network configuration.
3. The Contractor shall enable QoS on all cameras and intercoms for the video stream, audio stream, event/alarm data, management and metadata at the Owners request.
4. The Contractor shall select the appropriate mounting hardware for the situation.
5. All cameras shall be equipped with remote autofocus or autoback focus with the exception of fixed lens 180/360 degree cameras and encoded analog cameras.
6. Multi-sensor 180 and 360 cameras shall have each sensor optimally calibrated independently to the conditions.
7. All cameras shall be vandal proof and appropriate for the environment it is being installed in.
8. All cameras and devices shall have the latest VMS recommended firmware installed and all cameras of the same model shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.
9. The contractor shall coordinate with the owner for IP addressing, network configuration and multicast network configuration.
10. All cameras regardless of manufacturer/model shall have a consistent user name and non-standard password set. This shall be documented and provided to the owner and consultant prior to inspections.
11. Cameras and devices shall not be manufactured by or contain components manufactured by a federal, state or local government proposed blacklisted or sanctioned manufacturer or a subsidiary of those manufacturers.
12. Cameras and devices shall not be an OEM or "white label" product. The camera or device shall be manufactured by the named manufacturer.
13. The cameras and devices firmware shall be developed and manufactured by the stated manufacturer and shall not be developed, written or OEM by a 3rd party.
14. The camera requirements below represent general performance criteria. Approved equals will have slight differences in specifications. The Owner and

Consultant have complete discretion to reject approved equals that stray too far from the minimum requirements.

B. Camera Type 1

1. Native resolution of 5 megapixel.
2. This camera type to be utilized for Indoor applications: Common Areas, Hallways, SPED.
3. Using H.265, single dome camera.
4. Input power: PoE
5. Interior dome camera with an IK10 rating.
6. 5-year warranty.
7. Manufacturer:
    a. Interior – iPro WV-S25500-V3L

C. Camera Type 2

1. Native resolution of 5 megapixel.
2. This camera type to be utilized for Outdoor applications.
3. Using H.265, single dome camera.
4. Input power: PoE
5. Exterior dome camera with IP66 and IK10 ratings.
6. 5-year warranty.
7. Manufacturer:
    a. Exterior – iPro WV-S25500-V3LN

D. Camera Type 3

1. Native resolution of 5 megapixel 360-degree panoramic.
2. This camera type to be utilized for stairwells and serving line POS location.
3. Using H.265.
4. Input power: PoE
5. 5-year warranty.
6. Manufacturer:
    a. Interior – iPro WV-S4156A

E. Camera Type 4

1. Native resolution of 4x4k (33MP Multi-Sensor).
2. This camera type to be utilized for Outdoor stadiums, Stadium Parking Lots, HS/MS Parking Lots.
3. Using H.265, multi-sensor.
4. Input power: PoE
5. Exterior camera with IP67/66 and IK10 ratings.
6. 5-year warranty.
7. Manufacturer:
    a. Exterior – iPro WV-S8574L

F. Camera Type 5

1. Native resolution of 4x4MP (16MP Multi-Sensor).
2. This camera type to be utilized for Outdoor Building Perimeter,
3. Using H.265, multi-sensor.
4. Input power: PoE
5. Exterior camera with IP67/66 and IK10 ratings.
6. 5-year warranty.
7. Manufacturer:
    a. Exterior – iPro WV-S8544L

2.06 Protective Cages

A. The Contractor shall furnish and install protective wire cages over cameras in areas of high damage risk such as gyms or other locations noted.

B. 9 AWG white coated steel wire.

C. Furnish with mounting brackets and appropriate anchor.

D. Select appropriate size for location and type of device.

E. Cut cage as required to accommodate surface mounted conduit or field of view.

F. Manufacturer:

1. STI-USA or equivalent
    a. 7” x 7” x 7” wall/ceiling mount dome camera – STI-9729

2.07 Power Supplies

A. The Contractor shall provide and install a power supply for exterior cameras, PTZ Cameras, fiber optic media converters and other devices which require a dedicated power supply capable of outputting 24VAC and 28VAC simultaneously.

B. The Contractor shall connect each device to a 24VAC or 28VAC output according to the voltage drop to stay as close to 24VAC at the end point as possible based on actual field measurements.

C. The power supply shall be grounded with a 12 awg cable.

D. The Contractor shall provide (1) Altronix BC300 enclosure, (2) T2428300 transformers. Alternate configurations may be submitted for approval.

2.08 Voltage Regulator

A. The Contractor shall provide voltage regulators to convert from, 24 VAC/DC power to 12 VDC power where required.

B. Input: 24 VAC or 24 VDC

C. Output: 12VDC up to 3A continuous load.

D. Manufacturer:

1. Altronix VR5T

2. Or FBISD approved equal

2.09 Cabling

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Contractor in the IDF and provided by Contractor and installed by Contractor at the device.

Part 3 - Execution

3.01 Integration with Physical Security Systems

A. The video surveillance system shall be integrated with the Physical Security Systems via an Ethernet interface with the minimum follow features.

1. Graphical floor plan maps showing icons of all cameras, intercoms and other integrated systems.

2. Camera views associated with intercom stations and doors.

3. Camera views linked to other camera views for seamless tracking of a subject throughout a facility.
4. Device names brought in from the integrated systems.
5. Database entries for all actions performed.
6. Time syncing via common NTP server.
7. Microsoft Active Directory integration.
8. Microsoft Exchange integration for email notifications.
9. Intercom audio recorded to VMS server synchronized with the associated camera.

B. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

C. Refer to the individual specification sections for additional specific integration requirements.

D. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

3.02 System Programming

A. The Contractor shall provide all programming necessary for a turnkey system.

B. Programming shall include setting all required IP addressing, setting passwords, firmware upgrades, adding the devices into the software, setting video streams, motion detection areas, recording settings, device naming, mapping, cross system integration, etc.

3.03 System Mapping

A. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

B. The maps shall have links to the other levels/sections as well as the global map.

C. Cameras shall show their approximate field of view.

D. The floor plans shall include all integrated access-controlled doors, controlled overhead doors and integrated devices.

E. Contractor shall create map entities for intercom cameras for any intercom being recorded.

F. Contractor shall map integrated intrusion detection devices, areas and alarms.

3.04 System Partitioning, Zoning and Naming

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to control user access to certain areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as exterior, 1st floor, etc.

i. Device 1: Building name and floor number– Camera or other device name

ii. Device 2: Building name and floor - Camera or other device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor - Camera or other device name

ii. Device 2: Building name and floor - Camera or other device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. Camera Naming

1. All cameras shall be named based on Owner direction.

2. Multi-sensor cameras shall be named similar, and each sensor shall end with an identifier such as A, B, C and D so the images can be easily aligned in the client software by an end user.

E. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.05 VMS Video Streaming

A. All cameras shall have the following VBR streams configured. If a camera or VMS is not capable of the quantity of streams listed below when they shall be set for dual streaming at the Record settings and Live viewing settings.

1. Stream 1 (Record and High Resolution)

a. Interior Cameras:

i. 10 fps
ii. 1 keyframe (I-Frame) per 4 seconds
iii. Max resolution
iv. 100% recording with motion enabled for metadata.
v. VBR with no cap or high cap when smart codecs are enabled.
vi. H.264 Main Profile compression
vii. Smart codec enabled at the following settings:
viii. Medium (50%) dynamic compression setting
ix. Dynamic GoP of up to 30 seconds
x. Dynamic frame rate enabled
xi. AAC Audio encoding (for cameras with microphones connected or built into them).

b. Exterior Cameras:
i. 10 fps
ii. 1 keyframe (I-Frame) per 4 seconds
iii. Max resolution
iv. 100% recording with motion enabled for metadata.
v. VBR with no cap or high cap when smart codecs are enabled.
vi. H.264 Main Profile compression
vii. Smart codec enabled at the following settings:
viii. Medium (50%) dynamic compression setting
ix. Dynamic GoP of up to 30 seconds
x. Dynamic frame rate disabled

2. Stream 2 (Live)
a. 10 frames per second
b. ~850x450 resolution for 16:9 aspect ratio cameras and 640x480 for 4:3 aspect ratio cameras. Always maintain the native aspect ratio of the camera.
c. H.264 Main Profile compression
d. Smart codec enabled at a medium setting with a dynamic GoP of up to 8 seconds.
e. 1 key frame per 4 seconds
f. Automatic stream selection with dynamic resolution (resolution of camera window on VMS client)

3. Stream 3 (Low Resolution)

a. 10 frames per second

b. ~1280x720 resolution for 16:9 aspect ratio cameras and 1024x768 for 4:3 aspect ratio cameras. Always maintain the native aspect ratio of the camera.

c. H.264 Main Profile compression

d. Smart codec enabled at a medium setting with a dynamic GoP of up to 8 seconds.

e. 1 key frame per 4 seconds

f. Automatic stream selection with dynamic resolution (resolution of camera window on VMS client)

4. Stream 4 (Web/Remote/Mobile Client)

a. 5 frames per second

b. MJPEG at 50% quality when VMS requires for web or mobile clients to avoid transcoding from H.264.

c. ~850x450 resolution for 16:9 aspect ratio cameras and 640x480 for 4:3 aspect ratio cameras. Always maintain the native aspect ratio of the camera.

d. Data rate cap or as appropriate based on available bandwidth and use case.

e. Automatic stream selection with dynamic resolution (resolution of camera window on VMS client)

3.06 Camera Positioning Procedures

A. The Contractor shall set an initial aim, zoom, field of view adjustment, rotation and focus immediately after the camera is installed following the design intent on the drawings, camera schedule and industry best practices.

B. The Contractor shall then take screen shots from the camera's web interface, label them based on the drawings device number and present them to the Owner and Consultant for an initial review and comment. The Contractor shall furnish a battery powered PoE injector to power up the camera to provide the initial aim/focus and screen shots and shall not rely on the Owner's network or PoE switches to be online or available.

C. The Contractor shall then fine tune the cameras aim and field of view based on the Owner's and Consultant's feedback then update the screen shots and present them back to the Owner and Consultant.

D. After the cameras aim, zoom, field of view adjustment and focus are finalized by the Consultant, the Contractor shall submit the screen shots to the Owner to obtain their final sign-off or additional comments. If any comments are received, the Contractor shall make the adjustments necessary and take updated screen shots and submit for re-approval.

E. The above will not happen at the same time and the Contractor shall plan on multiple trips to the project to make the adjustments.

F. The Contractor shall include the final screen shots as part of the as-builts.

3.07 Coordination

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with camera positioning/repositioning and coordination as requested by Owner or Consultant including post final signoff.

3.08 Passwords

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

B. This secure password shall be set in the archiver default password field and each device in the video unit tab shall be set to use that set default.

3.09 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.10 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in three (3) four (4) hour sessions for administration and investigation.

2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance including lens and dome cleaning, focusing and positioning.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.11 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.12 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional video surveillance system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.13 Aesthetics

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.14 Hardware Layout

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.15 VMS Installation Practices

A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.16 Device Cabling/Wiring Installation Practices

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

L. No splices shall be installed in any cable.

3.17 Cable Termination

A. Termination hardware (patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.18 Elevator Interface

A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room when cameras are located within the elevator cab.

1. The Contractor shall provide an elevator security junction box located outside of the Elevator Machine Room, for interface of security devices to be located within the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.

2. Security J-box shall include a keyed lockable door. Additionally, security J-box shall have proper terminal strips suitable for terminating all cables and mounting electronics within the J-box.

3. The Electrical Contractor shall provide 120VAC power to this enclosure as required to power the electronics.

4. The Contractor shall provide any data cables to this enclosure as required.

5. Electronics for access control may be placed within this enclosure.

6. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.

7. Provide all cabling as required between the security system and elevator security J-box for all elevator interfaces.

8. Provide all required interface points for connecting to elevator travel cables.

9. Cables entering the elevator security J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to travel cables. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

10. The Contractor shall coordinate with the Elevator Contractor to ensure the appropriate cable is located within the elevator travel cable.

3.19 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.20 System Inspection

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contactor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

3.21 Labeling

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.22 Camera Installation

A. Contractor shall field verify all camera locations and positioning with Owner prior to installation.

3.23 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.
2. Contractor shall provide a document including the following:
    a. Camera label/identifier
    b. Location of each drop by orientation/permanent landmark in the room
    c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.24 Pre-Checkout

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The cameras are fully installed and functional.
2. Camera adjustments are complete to the Owner's satisfaction including.
    a. Aim/Zoom
    b. Focus/Back Focus
    c. Masking Zones
    d. Motion Detection Zones
    e. Pre-Sets/Tours

3.25 Final Acceptance

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.
2. Punch list items are complete.
3. As-built documentation is complete and submitted to Owner/Consultant.

3.26 Final Procedures

A. Perform final procedures in accordance with section 27 60 00.

End of Section

Section 27 66 00 – Intrusion Detection System

Part 1 - General

1.01 Scope

A. This specification section covers the furnishing and installation of a new and complete, low-voltage, Intrusion Detection System (IDS).

B. Contractor shall furnish and install intrusion detection hardware devices, mounting brackets, power supplies, switches, controls, consoles and other components of the system as required.

C. Provide necessary materials, hardware, software and cabling required to furnish a fully functional system as shown and specified.

D. Provide all required programming, testing and commissioning for a complete turn-key system.

E. The Contractor shall provide a 3rd party UL listed monitoring service.

F. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

G. Refer to Section 27 00 00 for additional project scope information.

1.02 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 51 00 – Distributed Communications Systems

I. Section 27 60 00 – Physical Security General Requirements

J. Section 27 62 00 – Electronic Access Control System

K. Section 27 64 00 – Video Surveillance System

1.03 Definitions

A. Refer to Section 27 00 00 for additional definitions.

1.04 Reference Standards and Codes

A. National Electric Code, Article 760.

B. National Fire Alarm Code (NFPA 72).

C. Administrative Council for Terminal Attachments (ACTA):

1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.

D. American National Standards Institute (ANSI):

1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

E. Federal Communications Commission (FCC):

1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.

2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).

F. The National Institute of Standards and Technology of the United States of America (NIST):

1. Federal Information Processing Standards Publications 197 (FIPS 197) – Advanced Encryption Standard (AES).

G. Underwriters Laboratories, Inc. (UL):

1. UL 50 - Enclosures for Electrical Equipment.

2. UL 294 – Access Control System Units.

3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.

4. UL 609 - Local Burglar Alarm Units and Systems.

5. UL 985 - Household Fire Warning System Units.

6. UL 1023 - Household Burglar Alarm System Units.

7. UL 1076 – Proprietary Burglar Alarm Units and Systems

8. UL 1610 - Central Station Burglar-Alarm Units.

9. UL 60950-1 - Information Technology Equipment - Safety.

10. UL 636 – Hold up alarms

H. Refer to Section 27 00 00 for additional requirements.

1.05 Qualifications

A. The Contractor shall be a Bosch Expert or Master certified dealer.

B. Refer to Section 27 00 00 for additional requirements.

1.06 Pre-Construction Submittals

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

D. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

3. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

4. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

5. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

6. Hardware Layouts: Include individual panel layouts, showing the number of controllers, sub-panels, and other associated devices per location.

7. Power Calculations: Include the anticipated power loads, number and type of power supplies including all power supply boards, number of 120VAC circuits required, battery backup including the quantities of batteries to meet requirements, PoE loads, fire alarm connection requirements, etc.

E. Refer to Section 27 00 00 for additional requirements.

1.07 Pre-installation Procedures

A. For in-use, existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses, passwords and pre-build out all the enclosures including the interconnects within the enclosure prior to being delivered to the project or installed.

B. The Contractor shall cable all monitored doors, detectors, etc. and terminate this cable in the control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices.

C. The Contractor shall program the intrusion detection system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, the full system functionality can be tested. Programming shall include all monitored doors, associated inputs, outputs, and interoperability regardless of final field device status.

D. The Contractor shall perform final connections and testing onsite when field devices has been installed.

E. Refer to section 27 00 00 for additional requirements.

1.08 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.09 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.10 System General Requirements

A. Acceptable manufacturers for intrusion detection system is Resideo or FBISD Design Manager approved equal.

B. The Basis of Design for the intrusion detection system shall be:

1. Main intrusion control panel, Honeywell (Resideo) VISTA-250BPT

2. Alpha Display Keypad, VISTA 6160

3. Eight input alarm module, VISTA 4208U

4. Panoramic 360 Ceiling 60’ motion, DS938Z
5. Panoramic 360 Ceiling 25’ motion, DS936
6. TriTech 60x60 PIR Microwave Detector, DS860
7. Long Range TriTech PIR Detector, DS720
8. 3/4 recessed gray door contact, Amseco AMS-25B-G
9. Overhead door contactsAmseco ODC-59A
10. Self Contained, dual tone surface mount indoor siren, SS-2
11. Relay Module - Interlock with Lighting Controls System, ADEMCO 4204

C. The intrusion detection system shall be a single zone at all schools.

1. Interlock with security system to turn off all contactor controlled fixtures upon arming of system.
2. Interlock with security system to turn on all contactor controlled fixtures upon intruder activation.
3. Interlock with security system to enable partial lighting when system is first disarmed via contactor schedule.
4. Intent is to have three inputs from security system: armed, disarmed and activated.

D. The only “delays” allowed for the intrusion detection system shall be where keypads are located.

E. For new construction projects, all intrusion control panels and associated power supplies shall reside in Mechanical Rooms, coordinate with MEP for locations. For renovation projects, control panels will be handled in a case-by-case scenario. If an existing control panel and power supply has already been established in MDF/IDF’s, then it shall remain. Control panels and power supplies shall be provided with dedicated 30AMP electrical receptacles located next to the panels on the fire rated plywood. Dedicated electrical receptacle(s) shall be connected to the Building’s Emergency Electricity Backup System. The master control panel shall not be plugged into a UPS. Control panels and associated power supplies shall be equipped with (12VDC / 24VDC) battery backup as required. Batteries shall be installed with a printed labels indicating the date of installation.

F. Dial out method shall be coordinated with FBISD Design Manager, FBISD IT, and FBISD security. Current method is IP based for primary call, back up is cellular. Coordinate with FBISD IT for cellular dialer information.

G. Provide emergency power for the control panels.

Part 2 - Products

2.01 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 Keypads, Push Button

A. 5-line by 32-character backlit LCD display.

B. UL Listed.

C. Requires 12 VDC @ 80 mA.

D. Manufacturer:

1. Vista 6160

2. Or FBISD approved equal

2.03 Protective Enclosure

A. The Contractor shall furnish and install an enclosure over the touch panel/keypad where required.

B. Clear polycarbonate

C. Open back

D. Hinged cover

E. Non-vented

F. Thumb turn or keyed lock

G. Furnish with appropriate mounting hardware

H. Furnish with conduit entry kit when surface mounted conduit is utilized.

I. Adjust size and type as required for the installation scenario

J. Manufacturer:

1. STI-USA or equivalent

a. Thumb turn – STI-7510C

b. Keyed lock – STI-7511C

2.04 Input Expansion Module

A. Provide input expansion modules for all devices. Controller onboard inputs are reserved for other uses. Inputs from keypads shall not be used.

B. 8 input expansion module.

C. Requires 12 VDC @ 35 mA.

D. Manufacturer:

1. Vista

2.05 Output Expansion Module

A. 8 output expansion module.

B. Dry contacts rated up to 24 VDC @ 1A.

C. Requires 12 VDC @ 150 mA.

D. Manufacturer:

1. Vista

2.06 Batteries and Backup

A. The Contractor shall provide a minimum of (2) 12V, 7ah, sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per power supply and (1) per control panel. Provide additional as required based on calculated power load.

B. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 8-hours.

C. Manufacturer:

1. Interstate Power Patrol FAS1075

2. Power Sonic PS-1270

3. Or approved equal

2.07 End of Line Supervision

A. All monitored intrusion detection devices shall include EoL monitoring.

B. Provide a dual 1k + 1k end of line (EoL) pre-built resistor pack. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

1. Adjust resistance values as required by the manufacturer.

2. .

2.08 Door Contacts/Door Position Switches (DC)

A. Recessed

1. Provide 3/4 inch recessed gray door contact (Amseco AMS-25B-G).

B. Overhead door

1. Provide Amseco ODC-59A

2.09 Motion Detectors

A. The motion detector shall be a multi-technology, IR and range adaptive radar device.

B. Reduces false alarms by sensing both heat, physical motion and compensation algorithms.

C. Wide angle: 60’ x 80’ standard coverage, selectable 25’ x 33’ coverage.

D. Long range: 8.5’ x 100’ standard coverage, selectable 3.3’ x 25’ coverage.

E. Active white light suppression

F. Dynamic temperature compensation

G. Draft and insect immunity

H. Sensor data fusion

I. Power requirements: 9-15 VDC

J. Maximum current draw of 26ma at 12VDC.

K. Can be mounted between 7’-10’ with no adjustments.

L. Provide with appropriate mounting hardware, Bosch B328 (wall), B338 (ceiling) or equal.

M. White.

N. Manufacturer:

1. Bosch DS860

2. Or FBISD approved equal

2.10 360 Motion Detectors

A. The motion detector shall be a multi-technology, IR and range adaptive radar device with anti-mask.

B. Reduces false alarms by sensing both heat, physical motion and compensation algorithms.

C. 360 Degree coverage: 52’ diameter.

D. Active white light suppression

E. Dynamic temperature compensation

F. Draft and insect immunity

G. Sensor data fusion

H. Power requirements: 9-15 VDC

I. Maximum current draw of 24ma at 12VDC.

J. Can be mounted between 8’-20’ with no adjustments.

K. Mounts to standard 1-gang 3.5” rectangular electrical box.

L. White.

M. Manufacturer:

1. Bosch DS938Z
2. Bosch DS 936
3. Or approved equal

2.11 Protective Cages

A. The Contractor shall furnish and install protective wire cages over devices such as motion detectors in areas of high damage risk such as gyms or other locations noted.

B. 9 AWG white coated steel wire.

C. Furnish with mounting brackets and appropriate anchor.

D. Select appropriate size for location and type of device.

E. Manufacturer:

1. STI-USA or equivalent
    a. Corner mount – STI-9619
    b. Wall mount – STI-9621
    c. Ceiling 360 detector mount – STI-9602

2.12 Intrusion Detection Panel Enclosures

A. Provide a power supply/chargers and sub-assemblies to power various intrusion controller boards, detectors, audible/visual alarms and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application.

B. Enclosures

1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures boards when required.
2. Wall mountable.

3. Include a cam-lock and tamper switch.
4. Provide with main backplane and door backplane.
5. Provide with power rocker switches between each transformer and the board.
6. Manufacturer:
    a. Altronix Trove2BH2 with TBHD2 door backplane or as appropriate for intrusion panel manufacturer.

C. Sub-Assemblies

1. The Contractor shall provide all sub-assemblies to meet the project requirements.
2. Access Control Module
    a. Independently controlled fused protected outputs:
        i. Fail-Safe and/or Fail-Secure power outputs.
        ii. Dry form “C” 5 amp rated relay outputs (fused).
        iii. Any combination of the above
3. Access Control System trigger inputs:
    a. Normally open (NO) inputs.
    b. Open collector sink inputs.
    c. Any combination of the above.
4. Multi-Output Power Distribution Module
    a. Single input distributed over eight (8) or sixteen (16) outputs.
    b. Fused protected outputs.
    c. Output terminals shall accommodate up to 12AWG wires.
5. Multi-Output Power Distribution Module with Dual Inputs
    a. Two (2) inputs distributed over eight (8) outputs.
    b. Outputs shall be configurable by input.
    c. Fused protected outputs.
    d. Output terminals shall accommodate up to 12AWG wires.
6. Power supplies and sub-assemblies shall be manufactured by Altronix or approved equal:
    a. Altronix ACMS8 – Dual input, eight (8) output, fused Access Control Module (UL listed Sub-assembly).

b. Altronix PDS8 - Dual input, eight (8) output, fused power distribution module (UL listed Sub-assembly).

c. Altronix PD16W – Selectable dual input, sixteen (16) output, fused power distribution module (UL listed Sub-assembly).

d. Altronix RSB2 – Rocker switches with mounting bracket.

2.13 Power Transformers

A. The Contractor shall provide all required transformers and power supplies.

B. The power supplies shall be hardwired. Pluggable “wall wart” transformers are forbidden.

C. Provide with enclosure as required.

D. 115 VAC input.

E. Provide a 16 VAC output @ 6.25A transformer to power the control panel.

F. Provide a 18 VAC output @ 16.7A transformer to power the power supply module.

G. Connect transformers outputs through rocker switches to control on/off power to the panels for service.

H. Manufacturer:

1. Altronix

a. 16VAC Transformer - T16100C

i. Mount above Altronix Trove 2 enclosure in the included Altronix CAB4 enclosure.

b. 18VAC Transformer - T1618300K

i. Mount within Altronix Trove 2 enclosure on main backplane in the upper left corner square punch.

2. Or approved equal

2.14 Cables

A. Provide cabling per manufacturer’s recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. All cabling shall be Orange.

C. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

D. UTP patch cables will be provided and installed by the Contractor in the IDF and provided and installed by Contractor at the control panels.

E. Door Contacts, Panic/Duress Buttons, mechanical sensors, etc.: 18-gauge, four-conductor, unshielded, stranded cable shall be provided for all door contacts. The cable shall be white in color and plenum rated.

F. Motion Detectors: 18-gauge, four-conductor, shielded, stranded cable shall be provided for all motion detectors. The cable shall be white in color and plenum rated.

G. Keypads/SDI2 Bus: 18-guage, four-conductor, non-shielded, non-twisted, stranded cable shall be provided for keypads. The cable shall be white in color and plenum rated. Keypad cabling shall not exceed 390 feet. Cable impedance shall not exceed 100 ohms.

H. Wireless Receivers/Repeaters Power Cable: 18-gauge, two-conductor, unshielded, stranded cable shall be provided for all wireless receivers and repeaters. The cable shall be white in color and plenum rated. The cable shall not exceed 328 feet. Increase gauge as required based on voltage drop.

I. POPIT Bus: 18-guage, four-conductor, non-shielded, twisted (6-twist per foot min), stranded cable shall be provided for the POPIT loop. The cable shall be white in color and plenum rated. Cable impedance shall not exceed 100 ohms. Do not exceed manufacturer recommendations for maximum cable length. Furnish and install a 33-kohm EoL resistor on the last device in the loop.

J. Follow manufacturer's recommendations for all systems cabling.

Part 3 - Execution

3.01 Physical Security Integration

A. The intrusion detection system shall be integrated with the electronic access control system.

1. The access control/intrusion detection interface shall be via an Ethernet interface. Contact closure integration is not acceptable.

B. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreements.

C. Refer to the Electronic Access Control specifications for additional specific integration requirements.

D. The Intrusion system shall be time syncing to a common NTP server across all security systems.

E. The Intrusion system shall synchronize users enrolled or removed through the access control system.

F. The Intrusion system shall disarm on first in authorized and valid card read. Authorized means the user has the appropriate permissions to disarm the intrusion system.

G. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

3.02 System Programming

A. The Contractor shall set the Ethernet communications to TCP/IP.

B. The Contractor shall enable 128-bit AES encryption when required.

C. The Contractor shall program all inputs EoL resistance values. All inputs shall have an EoL unless specifically submitted on and approved by the Consultant.

D. The Contractor shall configure mail server SMTP settings and port. The Contractor shall coordinate with the Owner on email accounts to be added.

E. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).

F. Programming operational parameters such as opening/closing reports and windows, system response text displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.

G. Programming passcodes according to the authorities and functions defined by the Owner.

H. The Contractor shall program all compliance and panel wide parameters including onboard and add-on module ethernet parameters, Cloud Remote Connect settings, report routing, power supervision, RPS parameters, miscellaneous settings, etc.

I. The Contractor shall set all point, point profiles, area and debounce times according to the requirements, best practices and Owner requirements. The Contractor shall create custom point profiles as required for desired functionality.

J. The Contractor shall set all Area necessary parameters including force arm/bypass, exit delay time, restart time, area type, part on, exit/entry delay warning, area re-arm time, etc.

K. The Contractor shall assist with entering users, authority levels and PINs.

L. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor.

M. Operational Testing: The contractor shall perform thorough operational testing, walk testing, and verify that all system components are fully operational.

N. Hard-copy System Printout: The contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.

O. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through.

P. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk-through.

3.03 System Partitioning, Zoning and Naming

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to allow arming and disarming of specific areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as 1st floor, gym, auditorium, etc.

i. Device 1: Building name and floor number – detector or device name

ii. Device 2: Building name and floor - detector or device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor - detector or device name

ii. Device 2: Building name and floor - detector or device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. Device Naming

1. All devices shall be named based on Owner direction.

E. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.04 Intrusion Remote Software Programming

A. The Contractor shall configure Bosch RPS to utilize the Owner’s existing central SQL server. Coordinate requirements with the Owner prior to setting up.

B. The RPS software shall be set to run as a service on server startup.

C. The latest panel firmware shall be loaded in for centralized updating and all panels shall be on the same firmware version.

D. The Contractor shall create all required Owner RPS users.

E. The software shall be set to auto synchronize the time based on server time that is synchronized to the Owner's NTP server.

F. The software shall be set to synchronize/receive panel data daily.

G. The software shall synchronize current panel events daily.

H. The Contractor shall set the panels Cloud ID in RPS to enable future Cloud functionality.

3.05 Monitoring Service and Communications Integration

A. The Contractor shall program the intrusion panels to communicate to the Owner's preferred monitoring service which may be their own internal monitoring or an external service.

B. The Contractor shall program all applicable route groups for primary and backup using the appropriate communication formats accepted by the monitoring service. Radionics Modem 4 is preferred when possible. Set AES encryption where required.

3.06 Motion Detector Installation Requirements

A. Install between 7' and 10' above finished floor unless manufacturer's specifications allow otherwise.

B. Point away from outside traffic. Microwave energy passes through non-metallic walls and can detect outside of the space.

C. Position 360 detectors farther from exterior walls.

D. Point or position away from direct and reflected sunlight.

E. Point or position away from glass or other objects that rapidly change temperatures.

F. Point or position away from moving or rotating objects such as fans.

G. Mount the detector on a solid and vibration free surface.

H. Avoid mounting the detector within 1 ft (minimum) of any fluorescent light fixture.

I. Long range, narrow angle detectors should be mounted in the center of hallways when possible.

J. Wide angle detectors should be mounted in corners of the areas being covered when possible.

K. Wide angle detectors mounted in spaces smaller than 25’ x 33’ should have the DIP switch set to reduce the PIR coverage and radar potentiometer turned down.

L. Long range, narrow angle detectors mounted in corridors shorten than 3.3’ x 25’ should have the DIP switch set to reduce PIR coverage and radar potentiometer turned down.

M. Detectors should have the down lens enabled unless specifically noted otherwise.

3.07 Acoustic Glass Break Detector Installation Requirements

A. Do not mount the detector with obstructions between the glass being protected and the detector.

B. Do not mount on the same wall as the glass being protected.

C. Do not mount the detector closer than 5 feet to the wall that the glass being protected is on, or any hard, sound reflecting surface.

D. Do not mount closer than 2 feet from mechanical outlets or within range of direct airflow of outlets.

E. Do not exceed maximum range which should be measured from the furthest lower corner of the glass to the detector.

F. When possible, mount within 10 to 20 feet from the glass, in-line with the glass’s center, and on the ceiling or opposite wall of the glass being protected.

G. The detector should be within ±30 degrees of the center of the glass being protected.

3.08 End of Line Supervision

A. The Contractor shall furnish and install end-of-line resistors to provide end-of-line supervision on all intrusion input devices. This shall include but is not limited to door position switches, motion detectors, glass break detectors, duress/panic buttons and all other inputs being monitored.

B. The Contractor shall furnish and install resistors as near to the field device as possible. Supervision resistance values shall be natively compatible with the associated control panel.

1. Bosch Security based installations shall utilize 1K resistors.

3.09 Wireless Survey

A. The Contractor shall perform a wireless survey prior to the purchase, rough-in, cabling or installation of the wireless devices.

B. The wireless survey shall be used to determine the optimal device placement which shall be documented and sent to the Consultant for review.

3.10 Passwords

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

3.11 System Grounding

A. The Contractor shall ground all components of the system to the telecommunications grounding system and ground fault detection shall be enabled according to UL requirements.

3.12 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.13 Training

A. Refer to Section 27 00 00 for additional requirements.

3.14 Warranty

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor shall guarantee all materials, equipment, etc., for one (1) year from date of substantial completion of work. This guarantee shall include labor, material, and travel time.

C. All Intrusion Alarm systems, materials, and labor shall be under warranty for 1 year from date of final acceptance.

3.15 General

A. Prerequisites

1. The Contractor shall maintain a competent (single point of contact) project supervisor, along with competent technical personnel acceptable to the Owner and Consultant, during the entire installation process. Best efforts shall be made to avoid change of the project supervision during the project without prior written approval from the Owner and/or Consultant.

2. The Contractor installing any equipment/devices shall be responsible for providing all interconnecting cables to and/or between same equipment that may be required to make equipment fully operational.

B. Requirements and Responsibilities

1. The Contractor shall provide, furnish, deliver, transport, erect, install, configure, and connect completely all of the material and equipment described herein or depicted on project drawings. The Contractor shall supply all other incidental material required, such as interconnecting cables, to make the work complete, and to install all systems in a turnkey operating condition.

2. Perform this work in accordance with acknowledged industry and professional standards and practices, existing build conditions, and as specified herein. Proved and install all materials, devices, components, and equipment for complete, operational systems.

3. Coordinate all efforts and verify field conditions with those of related trades. In the event of any conflicts, delays or improper preparatory work by others, notify the Owner or Owner's Consultant: The Owner and Owner's Consultant's decision will be binding.

3.16 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner and Owner's Consultant reserve the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Contractor shall exercise care during installation - damage to cables or equipment will not be accepted. The Contractor shall remove any damaged cabling or equipment and replace with new.

C. Contractor is responsible for providing a complete and functional intrusion alarm system.

D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

E. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

F. The Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

G. The Contractor shall provide rack shelves or rack mounting ears for any equipment that is not rack mountable. All equipment installed using shelves shall be fastened to the rack shelf.

H. Install plates as required on back boxes where they exist. Provide cut-in back boxes where boxes do not exist.

I. Install surface mounted cable raceway systems that match the surface color and/or the other surface mounted raceways, where cables cannot run within fishable walls.

J. The Contractor installing any RF devices shall be aware that RF devices may cause interference to equipment and shall take whatever precautions necessary to avoid causing interference.

K. The Owner will provide programming information needed to help Contractor with configuration of system. The Contractor shall have the responsibility to program the system, assure proper communications between controlling points and any monitoring companies, and to adjust any system or device causing false alarm conditions.

L. Consideration shall be given not only to operation efficiency, but also to overall aesthetic factors.

3.17 Coordination

A. Contractor shall provide up to 4 hours (up to two, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, zone coordination, rule creation and coordination as requested by Owner or Consultant.

3.18 Training

A. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 4 hours of scheduled and dedicated training time in two (2) two (2) hour sessions for system use and maintenance.

2. Contractor shall provide up to 1 hours of scheduled and dedicated training time in two (2) thirty (30) minutes sessions for system arming and disarming per site.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.19 Support

A. The Contractor shall make available technical resources, as deemed necessary by the Owner, for database integration projects.

3.20 Aesthetics

A. All cables terminating at the panel frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. A horizontal and vertical alignment for all mounting hardware shall be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured and level.

3.21 Hardware Layout

A. Hardware positioning and layout shall be according to project drawings.

3.22 Device Cabling/Wiring Installation Practices

A. Contractor shall coordinate with the Electrical Contractor their requirements for conduits and proper AC power to service all equipment installed by Contractor, in locations where power is not available.

B. Contractor shall provide for proper ground system to all equipment.

C. Each cable group that can cause interference to another group shall be separated by sufficient distance so as not to cause signal contamination or interference.

D. All external wire and cables shall be supported at least every five feet from the structure, or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables.

E. All cables, regardless of length, shall be marked with indelible color-coded labels within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified. Labels shall be directly hot stamped or factory stamped, closed sleeve method. Adhesive strip labels may only be used if protected by transparent heat-shrink tubing. There shall be no unmarked cables at any place in any part of any system. Marking codes used on cables shall correspond and be shown clearly on as-built drawings.

F. Each cable shall be marked at all cable ends with a standard nomenclature (Device, #, closet letter).

G. All cables shall be separated into like groups, according to signal or power levels, and routed separately to eliminate signal contamination and crosstalk - this includes both inside and outside of equipment racks.

H. All cables shall have 6-foot service loops neatly coiled in accessible ceiling. During initial cable rough-in, the Contractor shall have sufficient slack to route anywhere within Telecommunications Room. Coordinate exact panel and power supply mounting locations with Electrical Contractor.

I. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Velcro straps shall be installed snugly without deforming cable insulation. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost.

J. Cable Ties shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

K. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

L. Cables shall not run above red iron joist.

M. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

N. Contractor shall notify Owner or Owner's Consultant immediately if obstruction or hazard is discovered in a pathway provided by others.

O. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

P. No splices shall be installed in any cable.

Q. No security device cabling shall have an accessible disconnect outside of a secured equipment room or within a backbox.

R. Any exterior exposed will be contained in waterproof conduit with the appropriate waterproof fittings.

S. All cables are to run at right angles to the structure, placed above the ceiling in halls and corridors.

T. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors and ceilings, assuming any applicable codes and good engineering practice allows and suggests.

U. All cabling systems installed in public areas shall be installed within walls, ceiling or floors or within surface wiring pathways as dictated by codes and good engineering practices.

V. Contractor shall notify Owner or Owner's Consultant immediately if obstruction or hazard to cable paths are discovered and seek corrective actions

W. The cables shall be supported by properly insulated wire support hangers, bridal rings, "D" rings, ladder cable tray, or inner duct as may be necessary to support cables.

X. Contractor shall seal any cable penetrations they may use or make where the penetration is part of a firewall or acoustic barrier.

3.23 Equipment Cabinet Wire and Cable Installation

A. All power cables, control cables, and high level cables shall be grouped to one side of the equipment rack while low level cables grouped to the other side.

B. All equipment rack wiring and cabling shall be neatly laced, and ends dressed with heat shrink tubing, and all cables shall have service loops between the horizontal tie bar and the connection to equipment. Rack cabling shall be adequately supported with tie wraps or Velcro wire wraps, and horizontal support bars to rack frame as it enters or exits the front or back of equipment.

C. All equipment rack wiring and cabling shall be neatly dressed.

D. Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

3.24 Connectors/Connections

A. Moisture Resistance: All connectors shall be crimped or applied in such a way as to prevent moisture from entering the connector or cable.

B. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

C. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner, suited to the service of the wire, and as directed by the manufacturer. In all cases, where the manufacturer specifies the terminations, those terminations shall be used.

D. Termination Testing: The strength of the termination shall be tested by manually pulling on the connector and cable. Any terminations that exhibit movement, loose cable, or insecure connections shall be re-terminated.

3.25 Special Techniques

A. Waterproofing: Contractor shall be responsible for creating a waterproof seal in and around any openings the Contractor creates, or are created by others for use by Contractor, that enter or exist in a structure to the outside environment.

3.26 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for the telecommunication Contractor to pass cable through, shall be the responsibility of the security Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by, or for Contractor, and left unused, shall be sealed up as part of this work by the telecommunication Contractor.

3.27 Test Requirements for Device Cabling

A. Contractor shall perform continuity tests to ensure cables are free of shorts within the pairs, and shall verify cables for continuity, pair validity and polarity, and conductor position.

3.28 System Testing Procedures

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

B. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.29 System Inspection

A. Contractor shall coordinate with Consultant for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contractor shall demonstrate to Consultant the functionality of the system, including the selection of various display modes and accessing system functions.

D. Contractor shall verify with Consultant the precise positioning of all devices and shall make fine adjustments as requested.

3.30 Labeling

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on project as-built drawings.

B. Contractor shall label both ends of the cable within four (4) inches of the termination with the same label identifier. These will be machine printed, Brady (or equivalent) labels.

C. Panels shall have labels showing cable numbers and far end locations for each cable terminated in the cabinet.

3.31 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval. All documentation shall become the property of the Owner.

B. Documentation shall include the items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Device label/identifier

b. Location of each device by room or corridor number

C. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

D. Consultant will provide floor plans in paper and electronic formats (".dwg," AutoCAD and ".dxf") on which as-built construction information can be added. The Contractor shall modify these documents accordingly to denote as-built information as defined above and then return the documents to the Owner.

3.32 Final Acceptance

A. The Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

3.33 Closeout Procedures

A. Closeout Submittals: Contractor shall provide closeout documentation to the Consultant. The Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

B. Inspection: Contractor shall be present for the inspection by the Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications.

C. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet written system specifications, and/or unacceptable to the Consultant, shall be documented by the Consultant and provided to Contractor to rectify.

D. Re-Inspection: If a re-inspection is necessary, the costs of the Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

E. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Consultant.

3.34 Cleaning

A. Prior to system final turnover to Owner:

1. Remove all dirt and debris from equipment racks and equipment rooms.
2. Clean all equipment filters, vents, and fans.
3. Clean all enclosures and back box interiors thoroughly before installing plates, panels, or covers.

End of Section

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SECTION 310000 - EARTHWORK UNDER BUILDING SLAB

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Protecting and preserving trees and vegetation to remain.

B. Clearing, stripping, and grubbing of portions of sites which are below the building pads.

C. Stockpiling stripped topsoil in approved locations.

D. Excavating for and otherwise providing stable and compact subgrade below the building pads.

E. Placing and compaction of select fill under improved areas to conform to elevations indicated on the drawings.

F. Filling and finish grading of area around buildings and other improvements using imported topsoil per section 2.1,D.

G. Coordinating Work of other Sections affecting or affected by Work of this Section.

1.2 INSPECTION OF SITE

A. By making a proposal on the Project, the Contractor acknowledges:
1. That the Owner and Architect do not guarantee the accuracy, completeness, or suitability of the contents of the Geotechnical Report or Topographic Survey.
2. That he/she has visited the site to investigate the conditions affecting the Work and has satisfied himself/herself of the character, quality and quantity of surface and subsurface materials or obstacles to be encountered.

B. The Contractor will be required to establish, maintain and be responsible for all reference points, hubs, grades, elevations, lines, and surface measurements. If any discrepancies in the documents are found, the Contractor shall promptly notify the Architect and await instructions before proceeding.

1.3 QUALITY ASSURANCE

A. Inspection and Testing Laboratory Services: Test results shall meet or exceed the standards referenced.

1.4 REFERENCES

A. ASTM International (ASTM)
1. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3) – Test for Moisture Unit Weight Relations of Soils and Soil Aggregate.

2. D2922, Tests for Density of Soil and Soil Aggregate in place by Nuclear Methods.

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13- Project Management and Coordination.

PART 2 - MATERIALS

2.1 MATERIALS

A. Structural Fill: Sandy clay soils free of organic or other deleterious materials, and have a maximum clay lump size of less than three (3) inches. See Construction Documents for Liquid Limit and Plasticity Index per soils report.

B. Earth Fill: Shall be excavated material approved by Architect prior to its use as earth fill around building and landscaped areas, but not under building.

C. Stabilization Materials: Refer to stabilization section(s) in Division 31.

D. Topsoil: Shall be imported, and shall be free from clay, vegetation, debris, stumps, roots, stones larger than 3/4 inch diameter, or other objectionable matter.

PART 3 - EXECUTION

3.1 GENERAL

A. Unknown Utilities and Obstacles:
1. If any unknown or uncharted utilities or objects are encountered during excavation, promptly notify the Architect before proceeding. Arrange with utility and telephone companies for removal and relocation of their equipment, and capping of pipes and wiring as required.

B. Protection of Vegetation:
1. Rope or fence off areas of the site that are designated to remain with vegetation to prevent vehicular traffic and construction damage.
2. Provide wood barricades around trees and shrubs at their drip line in traffic areas to protect them from construction operations until Substantial Completion, or until barricade removal is directed by Architect.
3. Replace damaged trees and vegetation designated to remain with vegetation of equal kind and size. Follow supplier’s recommended procedures for planting necessary replacement vegetation.

C. Clearing, Stripping and Grubbing (General):
1. Remove brush, vegetation, debris, and surplus materials from the jobsite. Removal of other remaining impediments as may be necessary to properly execute the scope of this contract shall be included herein. Adhere to State and local code requirements for the disposal of trees and shrubs removed from the site.
2. Do not remove trees or shrubs without the specific approval of the Architect. Vegetation damaged, removed, killed, or constricted from normal growth patterns shall be replaced with a comparable item, or the full replacement amount credited to the Owner.

D. Drainage, Pumping and Grading:

1. Proper drainage of site shall be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit access to the site.
2. Contractor shall control the grading around building so that ground is pitched to prevent water from running into the excavated areas of building or damaging other structures.
3. Provide pumping required to keep excavated spaces clear of water during construction.
4. If any subgrade is damaged due to flooding, damaged area shall be removed and filled with select fill. Placement and compaction of select fill shall meet the requirements for placing and compacting select fill as specified below.
5. If the subgrade, due to any reason or cause, lose the required stability, density, or finish before the foundation structure is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

3.2 BUILDING FOUNDATION (PAD) PREPARATION

A. Site preparation area at buildings with and without adjacent sidewalks shall extend beyond the limits of the foundation area. See Construction Documents for Site Preparation limits.

B. Existing fill material, top soil vegetation, roots, debris, organic material and other miscellaneous debris shall be removed to a depth of 9 inches and legally disposed of. Actual removal depth may vary and will be determined at time of construction.

C. Over excavate the in-situ soils as required to allow the minimum amount of select structural fill to be placed beneath the slab to achieve the desired elevation. See Construction Documents for amount of select structural fill required per soils report.

D. After stripping, and excavating to the desired grade as indicated above, the exposed soil shall be proof-rolled to locate all soft or loose areas. Soils, which are observed to rut or deflect excessively under the moving load, shall be undercut and replaced with properly compacted structural fill. The proof-rolling and undercutting activities shall be witnessed by a representative of the geotechnical engineer and shall be performed during a period of dry weather.

E. Subsequent to proof-rolling, and just prior to placement of fill, the exposed subgrade within the construction areas shall be evaluated for moisture and density. The subgrade soils shall be at or above the optimum moisture content, and have an in-place dry density of at least 95 percent of the standard effort (ASTM D698) maximum dry density of the in-situ soils. If the moisture or density does not meet the above criteria, the subgrade shall be scarified to a minimum depth of 6 inches, and moisture adjusted to meet the requirements per the soils report as indicated on the Construction Documents.

F. If remediation is required, Contractor shall have any of the following remediation options:
1. Disking and drying with natural means (if the construction schedule allows).
2. Dry the surface soils by chemically treatment.
3. Remove the unsuitably wet soils and replace the wet soil with select fill having an acceptable moisture content.

The option will be entirely up to the Contractor and no extra will be paid by the Owner.

G. After proof-rolling and undercutting has been completed, and the subgrade tested and adjusted as necessary, fill placement may begin. The first layer of fill shall be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped subgrade soils.

H. Refer to construction drawings for information regarding lime-stablized subgrade treatment.

3.3 FILL PLACEMENT

A. Structural fill materials shall be as specified in Paragraph 2.1, A above. Structural fill shall be placed in maximum lifts of eight (8) inches of loose material and shall have a moisture content as indicated on the Construction Documents. If water must be added, it shall be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of structural fill shall be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts.

B. Each lift of structural fill shall be compacted as required per the soils report and as indicated on the Construction Documents. Care shall be taken to apply compactive effort throughout the fill and fill scope areas. The moisture content and the degree of compaction of the structural fill soils shall be maintained until the construction of structures above them.

C. Contractor shall be responsible for damage caused to structure because of over excavation or excavations left open during inclement weather. Should the subgrade, for any reason or cause, lose the required stability, density, or finish before the foundation structure is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

3.4 GRADING

A. Rough Grading: Contractor shall control the grading around building so that ground is pitched to prevent water from running into the excavated areas or damaging other structures. Furnish pumping required to keep excavated spaces clear of water during construction. If a foundation excavation must remain empty through a shut-down period, cover with boards and building paper and clean out immediately when work resumes. If any subgrade should be damaged due to flooding, damaged area shall be removed and filled with select fill.

B. Finish Grading:
1. After rough grading is completed, provide and place imported top soil in the amounts required to bring the rough grade to within two (2) inches of finish grade. This earth fill shall be placed in lifts not to exceed 12 inches after compaction and shall be compacted to a dry density of at least 95 percent of the ASTM D698 maximum dry density.
2. Assure bonding of layers of fill material in compliance with the specifications.
3. Final and fine grading shall be done using a tractor pulled landscape rake and hand raking removing all debris immediately prior to landscaping. The final graded ground surface shall be relatively smooth, free of organic material and in suitable condition to commence landscaping work.

C. Topsoil:
1. Contractor shall furnish all topsoil that may be required to provide finish elevations. Topsoil material shall meet requirements of Paragraph 2.1 of this Section. Spread minimum two (2) inches of topsoil over graded areas after rough grading has been completed.
2. At the completion of finish grading, ground surface shall be relatively smooth, free of organic material and in suitable condition to commence landscaping work.

3.5 INSPECTION AND TESTING LABORATORY SERVICES

A. Refer to Section 01 45 23, Inspection and Testing Laboratory Services for laboratory services to determine the liquid limit, plastic limit and plasticity index for soils and in-place density tests for compacted material.

B. The Contractor shall cooperate with the inspection and testing laboratory in all matters pertaining to the work.

END OF SECTION 31 00 00

SECTION 31 00 01 – SITE EARTHWORK

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all excavation, backfill, fill and grading required to complete the work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; excavation and backfill for electrical manholes, handholes, conduits, cables, raceways and ducts; embankment and grading; disposal of waste and surplus materials; and all related work such as sheeting, bracing, and dewatering.

B. All excavation, trenching and related sheeting, bracing, etc., shall conform to the requirements of OSHA's excavation safety standards, 29 CFR 1926.650 Subpart P.

C. Excavation, backfill, and compaction for structures and piping are included in other sections as listed below.

1.2 RELATED WORK

A. Section 31 23 00 – Grading Excavation and Fill

B. Section 33 05 28 – Trenching and Backfill for Utilities

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Specification for Concrete Aggregates.

2. ASTM Dl557- Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,00 ft-lbf/ft (2,700kN-m/m)

3. ASTM D1682- Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.

4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.

5. ASTM D4751- Standard Test Method for Determining the Apparent Opening Size of a Geotextile.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 PROTECTION

A. Sheeting and Bracing

1. Furnish, put in place and maintain such sheeting and bracing as may be required: by Federal, State and local safety requirements; to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall

be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill.

2. In order to protect adjacent structures, installation or removal of sheeting by vibratory or hammering methods shall not be allowed.

3. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.

4. Where sheeting and bracing is required to support the sides of excavations for structures, engage a professional Engineer, registered in the State of Texas to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design and certification of this shall be provided by the professional Engineer. Submit P.E. Certification Form to show compliance with this requirement.

5. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed.

6. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders and his/her failure to exercise his/her right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

7. No sheeting is to be withdrawn if driven below mid-diameter of any pipe and under no circumstances shall any sheeting be cut off at a level lower than 1-ft above the top of any pipe.

B. Pumping and Drainage

1. At all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Engage a Geotechnical Engineer registered in the State of Texas to design the dewatering system.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

3. Take all additional precautions to prevent uplift of any structure during construction.

4. Remove the dewatering equipment after the system is no longer required.

1.5 SOIL TESTING

A. Previous to the general placement of the fill and during such placement, the ENGINEER may select areas within the limits of the fill for testing the degree of compaction obtained. Cooperate fully in obtaining the information desired.

B. Payment for testing will be made by the CONTRACTOR as part of the project. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER, will be borne by the CONTRACTOR.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Select Common Soil and Structural Fill shall be as specified in Section 31 00 00 – Earthwork.

B. Crushed Stone

1. Crushed stone shall conform to Texas Department of Transportation Class 57 stone gradation.

C. Screened Gravel

1. Screened gravel shall be used for pipe bedding as detailed and at other locations indicated on the Drawings.

2. Screened gravel shall consist of hard, durable, rounded or subangular particles of proper size and gradation and shall be free from sand, loam, clay, excess fines and deleterious materials. The gravel shall be graded within the following limits:

Sieve Size	Percent Finer by Weight
5/8-in	100
1/2-in	40 to 100
3/8-in	15 to 45
No.10	**0 to 5**

PART 3 – EXECUTION

3.1 BACKFILLING - COMMON FILL

A. Common Fill may be used as trench backfill and fill against exterior walls of structures as indicated on the Drawings; as embankment fill; or in other areas as designated by the ENGINEER. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of 2-ft measured before compaction.

B. Common Fill shall be compacted to at least 95 percent of maximum density as determined by ASTM D1557, Method D.

C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material and for the placing of loam thereon.

D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.

E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.2 DISPOSAL OF SURPLUS MATERIAL

A. No excavated materials shall be removed from the site of the work or disposed of, except as specified by the ENGINEER. Materials shall be neatly piled so as to inconvenience as little as possible the public and adjoining property OWNERS until used or otherwise disposed of as specified below.

B. Suitable excavated material shall be used for fill embankments or backfill on the different parts of the work as required.

C. Surplus fill shall become the property of the CONTRACTOR and shall be removed and disposed offsite.

3.3 DISPOSAL AND REPLACING OF ROCK

A. Remove and dispose of all pieces of ledge and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere on the work, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the ENGINEER.

B. Fragments of ledge and boulders smaller than 50 lb weight may be used in backfilling trenches unless in the opinion of the ENGINEER the quantity is excessive, in which case he/she may order the removal and disposal of some of this rock. The small pieces of rock used as backfill shall not be placed in trenches until the pipe has at least 2-ft of earth over it. Place these pieces of stone in thin layers alternating them with earth to be sure that all voids between the stones are completely filled with earth to prevent the occurrence of voids and settlement which will result therefrom.

C. Rock may be used in embankment fill only with the approval of the ENGINEER.

3.4 GRADING

A. Grading in preparation for placing of loam, planting areas, paved walks and drives and appurtenances shall be performed at all places that are indicated on the Drawings, to the lines, grades and elevations shown and otherwise as directed by the ENGINEER and shall be performed in such a manner that the requirements for formation of embankments can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of grading it is not possible to place any material in its final location, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.

C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 4-in in their greatest dimensions will not be permitted in the top 6-in of the finished subgrade of all fills.

END OF SECTION 31 00 01

SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for site clearing which may consist of:

1. Protection of trees indicated to be preserved.

2. Protection of above-ground and below-ground existing improvements indicated to be preserved.

3. Clearing, grubbing, removal and disposal of trees, stumps, brush, roots, vegetation, logs and rubbish.

4. Removal and disposal of above-ground and below-ground materials and existing improvements, including building demolition if any, as indicated.

5. Stripping and stockpiling of topsoil.

6. Stripping and stockpiling natural leaf mulch.

1.2 SUBMITTALS (NOT USED)

1.3 JOB CONDITIONS

A. Conduct demolition operations and removal of debris in accordance with governing regulations and Section 024117 - Demolition of these Specifications.

B. Ensure minimum interference with adjacent occupied or used facilities.

C. Exercise care to protect adjacent building, structures, and persons.

D. Above-ground and below-ground existing improvements, indicated to remain, shall be protected from damage prior to and during construction operations.

E Tree Protection

1. Trees to be preserved shall be protected by barricades to avoid any confusion and damage prior to site clearing operations.

2. Contractor shall install barricades 3 ft. beyond drip line of trees to be protected. Construction equipment or storage activities shall not be permitted within the fenced area.

F. Protection of Existing Utilities and Adjacent Work

1. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. When working near public and private utility company lines, Contractor shall contact the local utility coordinating committee, or the utility company involved to locate their lines.

2. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.

3. If it is determined by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed.

4. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and the encountered utilities are damaged by continuation of the work, Contractor shall repair, at this own expense, such damage to the satisfaction of the Owner and the Utility Company. The Contractor shall be responsible for all costs to repair the damage.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING

A. Trees to be removed, stumps, brush, roots and vegetation shall be removed to a depth of not less than 2 feet below original or finish ground level, whichever is lower.

B. Miscellaneous vegetation, logs and rubbish shall be removed in their entirety, within the limits of improvements.

D. Topsoil shall be stripped to underlying subsoil. Topsoil shall be defined as friable organic clay loam surface soil, reasonably free of clay lumps, stones, weeds, roots and other objectionable material. Topsoil shall be safely stockpiled on the Site. Stockpiles shall be constructed to freely drain surface water.

E. Depressions caused by clearing, grubbing and stripping operations shall be filled with approved backfill material, unless further excavation is required by the construction operations. Backfill shall be placed in accordance with Section 312300 – Excavation, Grading, and Fill of these Specifications.

3.2 REMOVAL OF IMPROVEMENTS

A. Above-ground and below-ground existing improvements shall be removed in their entirety, except for utilities which shall be removed only to the extent indicated. Where utilities are indicated to be removed in part, the ends of the remaining utilities shall be permanently plugged with Class 3000 concrete.

3.3 DISPOSAL OF MATERIALS

A. Materials not scheduled to be salvaged shall become the property of the Contractor and shall be removed from the Site and legally disposed of. Burning or burying cleared, grubbed and demolition waste materials on the Site shall not be permitted.

B. Remove items, without damaging, scheduled to be salvaged as directed by the engineer and placed in designated storage area.

END OF SECTION 31 11 00

SECTION 31 22 16
FINE GRADING

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 the work specified in this section.

1.2 RELATED SECTIONS

A. Turf and Grasses: Section 32 92 00
B. Topsoil: Section 32 22 17

1.3 SCOPE

A. Machinery restrictions
B. Site preparation for grass areas
C. Finished grading
D. Prevention of excessive weed growth in lawns

PART 2 – PRODUCTS

2.1 TOPSOIL

A. Topsoil for all fine grading operations shall be classified as “Enriched Top Soil” made from sandy loam with organic compost, free of debris or any vegetative matter.

1. Living Earth Technology, Houston, Texas (713)466-7360 5802 Crawford Road, Houston, Texas 77041
2. Nature’s Way Resource, Conroe, Texas (936)321-1200 101 Sherbrook Circle, Conroe, Texas 77385
3. The Ground Up, Houston, Texas (281)970-0003 9945 Windfern Road, Houston, Texas 77064

B. If topsoil from the existing site excavation and striping is available and can be utilized, topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics (Ref Section 322217 for additional information):

1. pH value of between 5.5 and 6.5
2. Liquid limit: 50 or less
3. Plasticity index: 20 or less.
4. Gradation: maximum of 10 percent passing the No. 200 sieve.

2.2 SUBMITTALS

A. Contractor shall submit small bag of soil sample to landscape architect for approval prior to deliver material to site.

PART 3 - EXECUTION

3.1 GENERAL

A. Finished grading shall be defined as placing and grading of additional soil (topsoil 2” minimum) required bringing the grade to the required grades for lawns. As well as smooth out rough areas. Where practical and as directed, the use of heavy machinery shall be kept to a minimum.

3.2 PLACEMENT OF FINE GRADE MATERIALS

A. Clear the subgrade of stones larger than 3 inches (3") in any dimension, and of concrete, wood, construction debris, and other deleterious matter. Excavate to a depth of 12 inches (12") all areas that have become saturated with oil, gasoline or bituminous products and backfill with clean earth.
B. Import topsoil directly to site of deposition or stockpile new topsoil on site in quantity needed to produce the required depth after spreading. Protect topsoil piles from erosion with tarpaulins and limit boards.
C. Spread topsoil to a minimum settled depth of 2 to 3 inches and feather smoothly into finished grade at edges so as to blend with adjacent ground shapes.
D. Exercise precautions to keep the topsoil friable and porous. Do not handle or work topsoil when it is excessively wet, or during a rainfall. Do not place topsoil on any subgrade that has not been loosened or tilled or allowed for drainage. Loosen and till the full depth of the topsoil and re-till any areas that become unduly compacted by vehicular movement.

3.3 FINE GRADING

A. The Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the landscape architect.
B. Hand rake the surface, removing all clods and undesirable material greater than one half inch (1/2") from ground surface. Fill all low spots with specified materials and cut irregularities to the acceptance of the landscape architect.
C. An acceptable fine grade shall be free from depressions greater than 6 inches (6") over any given space of 25' except at grade transitions which shall be gradual and even.
D. During the finished grading operations, all swales and additional swales that may be required to drain areas shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water.
E. To prevent excessive weed growth in the lawn areas, the contractor should be prepared to immediately install the lawn upon the completed and acceptable finished grade.

3.4 CLEAN UP AND PROTECTION

A. After completion of fine grading and top soiling operations, do not drive trucks or other heavy equipment over finished areas.
B. Upon completion of the work, remove all debris and excess material from the site so that the area is left neat and clean.

END OF SECTION

SECTION 31 22 17
TOPSOIL

PART 1 - GENERAL

1.1 SCOPE

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

1. pH value of between 5.5 and 6.5
2. Liquid limit: 50 or less
3. Plasticity index: 20 or less.
4. Gradation: maximum of 10 percent passing the No. 200 sieve.

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavation and embankment operations have been completed to correct lines and grades.

3.2 TOPSOIL EXCAVATION

A. Strip off topsoil from the area to be excavated to a minimum depth of 6 inches, unless indicated otherwise on the Drawings.

B. Stockpile topsoil in a designated location for reuse. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.3 PLACEMENT

A. For areas to be seeded or sodded, scarify or plow existing material to a minimum depth of 4 inches, or as indicated on the Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with an appropriate lawn roller to consolidate topsoil.

B. For areas to receive shrubs or trees, excavate existing material and place topsoil to the depth and dimensions shown on the Drawings.

3.4 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

SECTION 31 23 00 – GRADING, EXCAVATION AND FILL

PART 1 – GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Protection of Trees

B. Field Engineering for Site Layout.

C. Testing Laboratory Services.

D. Fill Material for Pavement Subbase.

E. Concrete Reinforcing.

F. Cast-In-Place Concrete.

G. Informational Reference to Site Survey and To Subsurface Conditions.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM D 698, Test for Moisture-Density Relations of Soils (Standard Proctor).

2. ASTM D 2922, Test for Density of Soil in Place by Nuclear Method.

3. ASTM D 2487, Classification of Soils for Engineering Purposes.

1.3 SUBMITTALS

A. SAMPLES:

1. Submit 10-pound sample quantity of fill materials.

2. Submit 20-pound sample quantity of topsoil material.

3. Pack tightly in containers to prevent contamination.

1.4 GRADES

A. Carefully compare new grade requirements with existing conditions.

B. Provide necessary earth, grading and shaping work.

C. Extra payment will not be authorized for overage or shortage of material.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Sub base material: unwashed pit run or crushed gravel, crushed stone, or crushed slag, naturally or artificially graded with maximum aggregate size of 1-1/2 inches, as acceptable to testing laboratory.

B. Backfill and fill material: soil materials free of debris, waste, frozen matter, vegetable and other deleterious matter, as acceptable to testing laboratory.

C. Select fill: imported lean clay with a narrow plasticity index (pi) range of 10 to 15.

D. Lime treated structural fill: on-site clay mixture, free of silt, loam, friable or soluble materials and organic matter; treated in 6-inch lifts with 36 pounds per square yard of hydrated lime.

E. Backfill:

1. Free from rocks larger than 3 inches in size, alkali, salt, petroleum products, debris, waste, roots, vegetable, and other deleterious matter.

2. Excess non-vegetated excavated soils available from site may be used if conforming to specified requirements.

F. Lime: material conforming to SDHPT item 264, "hydrated lime and lime slurry".

G. Soil filter fabric: Irafi "1405" is specified; Dupont "Typar" is acceptable or approved equal.

PART 3 – EXECUTION

3.1 OBSTRUCTIONS

A. Remove obstructions within lines of improvements.

B. Refer obstructions of questionable nature to engineer.

C. Remove abandoned foundations down to 12 inches below finished grade, or the finished elevation of pavements and walks unless indicated otherwise on the drawings.

D. Remove foundations of light standards completely.

3.2 STRIPPING

A. Strip entire area to receive pavement and slabs on grade to a minimum depth of six inches to remove soil containing vegetated material.

B. Remove vegetated material from site as waste.

C. Remove topsoil; spread on areas already graded and prepared for topsoil, or deposit in storage piles convenient to areas subsequently to receive topsoil.

D. Scarify existing asphalt surfacing and flexible base course material and remove from site.

E. Remove existing site improvements in areas scheduled to receive lawns, buildings, and pavements.

F. Stripped material becomes property of contractor; remove from project site immediately and dispose of properly.

G. Maintain site surface drainage during construction.

3.3 EXCAVATION FOR UTILITY TRENCHES

A. Excavate using ladder-type trenching machine or backhoe unless indicated otherwise.

B. Cut trench sides vertical from trench bottom to one foot above top of pipe; slope back on stable slope above that point.

C. Extend trench width minimum 6 inches and maximum 18 inches each side of pipe.

D. Excavate trench to a minimum depth of 4 inches below bottom elevation of proposed pipelines.

E. Leave no more than 500 feet of trench open at one time.

F. Where augured hole is indicated, provide opening no larger than one inch greater than outside diameter of pipe bell.

3.4 DEWATERING

A. Keep excavations dry; maintain dewatered condition for depth of one foot below excavation bottom.

B. Operate suitable pumps necessary to keep excavations continuously free of water.

C. Discharge drainage waterlines into approved sewers only with appropriate approvals; use of sanitary sewer is prohibited.

D. Direct surface drainage away from excavated areas.

E. Control grading adjacent to excavations to prevent water running into excavated areas.

3.5 PERIMETER BACKFILL

A. Backfill exterior side of perimeter of structure with lime-treated on-site clay materials, carrying such fill up to indicated sub grades.

B. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

C. Commence backfilling after underground work has been inspected, tested, forms removed, and excavation cleaned of trash and debris.

D. Place and compact backfill to minimize settlement and avoid damage to work in place.

E. Place backfill simultaneously on both sides of freestanding structures; prevent wedging action against structure.

F. Place materials in successive horizontal layers of not more than 8 inches (4 inches for hand- held tamping equipment) and uniformly compacted to 92% of maximum density as confirmed by testing laboratory.

3.6 UTILITY TRENCH BACKFILL

A. Pipe bedding and backfill requirements for sanitary sewers shall be as specified in Section 333100, Sanitary Sewage Systems.

B. Pipe bedding and backfill requirements for storm sewers shall be as specified in Section 334100, Storm Sewage Systems.

C. Pipe bedding and backfill for water distribution system piping shall be in accordance with Fort Bend County "Specifications for Water Main Construction and Materials" and "Specifications for Water Taps and Service Lines", 3/4-inch through 2-inch, with latest addenda and amendments thereto.

D. Backfill trench as soon as possible after pipe has been laid, jointed, and inspected; complete backfilling at end of each day.

E. Within pipe zone: place backfill material and hand tamp in 6-inch layers to one foot above top of pipe.

F. Use of bulldozer or similar tracked equipment is unacceptable for compaction.

3.7 PREPARATION OF SUBGRADE FOR PAVING, WALKS AND EXTERIOR SLABS

A. Cut and fill areas as required.

B. Proof roll sub grade with heavy roller. Cut out any soft area that cannot be compacted by surface rolling and replace with compacted select fill.

C. Provide select fill at areas where required to elevate sub grade. Lime stabilization: stabilize to depth of 8 inches with lime slurry in accordance with TxDOT Item 260. **Subgrade beneath sidewalks shall not be lime stabilized.**

D. Compact to not less than 85 to 92% of maximum density in accordance with ASTM D698 as confirmed by testing laboratory; with moisture content for compacted material within +/- 2% of optimum moisture.

E. Maintain site surface drainage during construction.

3.8 ROUGH GRADING

A. Shape sub grade to allow for maximum amount of natural settlement and compaction.

B. Remove debris, roots, branches, stones, in excess of 2 inches in size.

C. Remove subsoil which has been contaminated with petroleum products.

D. Excavate areas, to sub grade elevation, which are to receive paving and sidewalks.

E. Bring sub grade to required levels, profiles and contours, making gradual changes in grade; blend slopes into level areas.

F. Slope grade away from building minimum 2 inches in 10 feet unless indicated otherwise.

G. Cultivate sub grade to a depth of 3 inches where topsoil is to be placed; repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub grade.

H. Maintain site surface drainage during construction.

3.9 SURPLUS MATERIALS

A. Remove surplus subsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

3.10 CLEAN-UP

C. Remove temporary structures, rubbish, and waste materials from work site daily.

END OF SECTION 31 23 00

SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding, the construction of temporary swales and sedimentation basins as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction activities shall be protected from erosion.

B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including A-Procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.

B. Section 31 11 00 Clearing and Grubbing

C. Section 31 23 00 Grading Excavation and Fill

D. Section 33 05 28 Trenching and Backfill for Utilities

E. Section 33 40 00 Drainage

F. Texas Department of Transportation’s Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2014)

1.3 PERMITS (NOT USED)

1.4 APPLICABLE PUBLICATIONS (NOT USED)

1.5 PROTECTION OF ADJACENT WORK (NOT USED)

1.6 DEFINITIONS

A. Best Management Practices (BMP's) means physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices , when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

B. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, San Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.

C. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such areas as are designated on the plans and in accordance with these specifications

D. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

E. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.

F. Sediment Basins: A sediment basin is a temporary basin or dam constructed across a waterway or excavated location to intercept sediment-laden runoff and to trap and retain the sediment. A sediment basin is usually installed at points of discharge from drainage areas greater than 5 acres. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

G. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings

H. Rock Filter Dams: Rock filter dams are temporary berms constructed of stone to intercept and slow storm water runoff to retain sediment on the construction site.

1. Depending upon the type of rock filter dam specified in the construction plans as Type 1, 2, 3, or 4, the aggregate fill may be unwrapped, wrapped in twisted hexagonal wire mesh, or confined in a gabion wire basket. Applications of RockFilter Dams are as follows:

a. Type 1 dams may be used at toe of slopes, around inlets, in small ditches, and at dike or swale outlets. Type 1 dams are recommended for erosion and sediment control from a drainage area of 5 acres or less.

b. Type 2 dams may be used in ditches and at dike or swale outlets.

c. Type 3 dams may be used in stream fl

d. Type 4 sack gabions may be used in ditches and smaller channels to form an erosion and sediment control dam

1.7 QUALITY ASSURANCE

A. Codes and Standards: Install and maintain erosion control systems in compliance with all authorities having jurisdiction.

1.8 PROJECT/SITE CONDITIONS (NOT USED)

1.9 SUBMITTALS (NOT USED)

PART 2 – PRODUCTS

2.1 SUSTAINABLE MATERIALS

A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.2 GRASS

A. Materials for erosion control seeding shall conform to TxDOT Item 164.

B. Materials for erosion control sodding shall conform to TxDOT Item 162.

2.3 FERTILIZER

A. Materials for fertilizing erosion control seeding and/or sodding shall conform to TxDOT Item 166.2

2.4 WATER

A. Use clean potable water for maintaining the grass developed after erosion control seeding and/or sodding. Water shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

2.5 SILT FENCE

A. Geotextile fabric for Silt Fences must meet the TxDOT Departmental Material Specifications DMS 6230 Temporary Sediment Control Fence Fabric.

2.6 BALES

A. Standard rectangular hay bales bound by baling wire, clean and dry

2.7 INLET PROTECTION BARRIERS

A. Geotextile per 2.5 Silt Fence above.

B. Hardwood Posts shall be 2x2 minimum length 4 feet.
C. Net reinforced fence shall be 2 inch by 4 inch welded wire fabric mesh. The mesh support height shall be the equivalent height, or greater, of the geotextile fabric to be attached.

2.8 STABILIZED CONSTRUCTION ACCESS

A. Materials to be per TxDOT spec section 506.2.E.1 for Type 1

2.9 ROCK FILTER DAM

A. Materials. Geotextile fabric shall consist of a woven monofilament or spunbond nonwoven

fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Geotextile fabric shall equal or exceed the following average roll values or as directed by the Engineer:

1. Minimum average roll value.

a. Elongation – 50 percent.

b. Grab Strength – 200 pounds.

c. Puncture Strength – 75 pounds.

d. UV Stability (retained strength) – 50 percent after 500 hours of exposure.

2. Maximum average roll value.

a. Apparent Opening Size (AOS) – 0.6 mm/#30 US sieve.

B. Geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot, insects, and deterioration resulting from exposure to sunlight or heat. Geotextile fabric shall provide an expected useable life comparable to the anticipated construction period.

C. Aggregate for the rock filter dams shall consist of crushed stone. Aggregate particles 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. Aggregate shall be cubic or rounded form, not elongated, flat, shapes. Spalls, fragments, and chips shall not exceed 5 percent by weight. Crushed concrete shall not be substituted for the crushed stone unless as approved by the Engineer. Aggregate size shall depend upon the type ofrock filter dam specified in the construction plans. Aggregate size based on type of rock filter dam is as follows:

1. Type 1: 3 inches to 5 inches, open-graded.

2. Type 2: 3 inches to 5 inches, open-graded.

3. Type 3: 4 inches to 8 inches, open-graded.

4. Type 4: 3 inches to 5 inches, open-graded.

D. Mesh is required for reinforced type rock filter dams. Mesh shall be 20 gauge galvanized double twisted hexagonal wire mesh with 1-inch diameter hexagonal openings. Mesh wire shall be zinc coated prior to being double twisted. Reinforcing spiral binders, lacing wire, and stiffeners shall be made of wire having the same coating material and same wire size as the wire mesh. Gabion wire baskets shall equal or exceed the requirements of the wire mesh.

PART 3 – EXECUTION

3.1 GENERAL

A. Protection

1. Protect benchmarks, monuments, existing structures, existing fences, existing roads, existing sidewalks, existing paving, existing curbs, and other features indicated on Drawings to remain, or not indicated to be removed, from damage and displacement. If damaged or displaced, notify Engineer and correct defects as directed.

2. Protect above and below grade utilities which are to remain.

B. Preparation:

1. Use all means necessary to control dust on and near the work, and on and near off-site storage, and spoil areas, if such dust is caused by performance of the work of this Section, or if resulting from the condition in which Project Site is left by Contractor.

2. Moisten surfaces, as required, to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on Project Site.

C. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations

D. Minimize the time areas are to be exposed without vegetative cover.

E. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.

F. Store construction materials in designated areas away from drainageways and low areas.

G. Provide portable toilets and properly dispose of sanitary sewage.

H. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.2 INSTALLATION OF EROSION CONTROL DEVICES

A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract.

1. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 Clearing and Grubbing.

1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints.

a. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.

2. Drive support post into ground not less than 18 inches.

3. Excavate a 4-inch-wide by 4-inch-deep trench on up-slope side of silt fence.

a. Line trench with silt fence fabric material.

b. Backfill trench with soil or gravel.

C. Install straw bale fence at completion of grading operations in affected area as indicated on drawings.

1. Install erosion control devices at storm sewer inlets immediately after completion of the storm sewer.

2. Place straw bales in a single row, lengthwise on the contour, and embedded 4 inches into soil.

3. Secure each individual bale in place by stakes or reinforcement bars driven through bales into the ground to a depth of not less than 18 inches.

D. Install inlet protection barriers at curb inlets and at area inlets.

E. Install straw bale fences as ditch checks in drainage ditches.

F. Install Stabilized Construction Access per TxDOT specification 506.4.C.5.

G. Rock filter dams shall be installed so as to prevent downstream deposition of sediment and debris from the construction site. Rock filter dams shall be constructed to meet the following criteria:

1. Type 1:

a. Non-reinforced.

b. Height: 18-24 inches

c. Top width: 2 feet minimum.

d. Upstream and downstream side slope of dam: 2:1 maximum.

e. Open graded aggregate 3-5 inches.

2. Type 2:

a. Reinforced with wire mesh.

b. Height: 18-36 inches.

c. Top width: 2 feet minimum.

d. Upstream and downstream side slope of dam: 2:1 maximum.

e. Open graded aggregate 3-5 inches.

3. Type 3:

a. Reinforced with wire mesh.

b. Height: 36-48 inches.

c. Top width: 2 feet minimum.

d. Upstream and downstream side slope of dam: 3:1 maximum.

e. Open graded aggregate 4-8 inches.

4. Type 4:

a. Reinforced in a gabion wire basket.

b. Height: 30 inches minimum.

c. Top width: 2 feet minimum.

d. Upstream and downstream side slopes of dam: none specified.

e. Open graded aggregate 3-5 inches.

5. The separation geotextile fabric and wire mesh shall be sized and placed in accordance with the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The separation geotextile fabric may be omitted only as approved by the Engineer. The separation geotextile fabric and wire mesh shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel prior to aggregate placement. Sack gabions for Type 4 rock filter dams shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel, as well.

6. Aggregate fill shall be placed to the width, length, height and slopes in accordance with this specification and the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The height of the dam shall be measured vertically from the existing ground to the top of the filter dam. The length of the dam shall be measured across the top centerline of the dam from embankment to embankment and includes the additional length embedded into the embankment. Width of the dam shall be measured along the top face of the dam.

7. Wire mesh shall be folded upstream side over the aggregate fill and tightly secured to itself on the downstream side using wire tires. Hog rings may be substituted for wire ties.

8. Additional aggregate fill or gravel bags shall be placed and secured at the embedded section to prevent low flows from short circuiting the dam at the adjacent dirt embankment area.

9. The Contractor shall be responsible for periodic reshaping, repairing, and maintaining of rock filter dams as directed by the Engineer.

10. The Contractor is responsible for removal and proper disposal of sediment and debris from the rock filter dam. Removed sediment and debris shall not be allowed to flush into the storm sewer system, waterways, jurisdictional wetlands, or onto adjacent properties. Sediment deposits shall be removed before they reach one-third of the height of the dam. Uncontaminated sediment can be placed at the project spoil site or, if properly handled, spread out to supplement fill requirements. If sediment has been contaminated, then it shall be disposed of in accordance with the applicable federal, state, and local regulations. Offsite disposal shall be the responsibility of the Contractor. Contractor is encouraged to reuse aggregate and wire mesh if remaining materials meet original spec requirements.

3.3 EROSION CONTROL SEEDING

A. Exposed fill and stockpile areas shall be protected from windborne erosion if the phasing of the construction operations is anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. At completion of stockpiling operations, stockpiles shall be shaped and graded to drain. Provide a layer of mulch to all sides of the stockpile to protect the stockpile from windborne erosion.

B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for

Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.

C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.4 TEMPORARY SWALES

A. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.

B. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.

C. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.

D. Swales shall have erosion control barriers as required in these specifications.

3.5 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's Geotechnical engineer.

B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulching seeding, sodding, or other method as approved.

D. Where cut slopes of more than 5 feet deep, extend more than 100 feet in length, contractor shall provide a backfill drain at the top of the slope to ease in drainage and erosion control.

3.6 SEDIMENTATION BASINS

A. Sedimentation ponds shall be provided when designated on the plans.

B. All drainage from cleared areas shall be routed through the sedimentation basin.

C. Contractor will be responsible for the operation and maintenance of the pond during construction.

3.7 MAINTENANCE

A. Check all erosion control measures after each rainfall event to ensure that they are in proper working order.

1. Immediately restore all measures to installed condition.

2. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, all temporary swales must be reworked to meet final conditions as set forth in the drawings and specifications.

3. The Contractor shall assure that all subwork with other contractors at the site understand the importance of the erosion control features. The Contractor shall require all subcontractors to respect the function of the erosion control features and

enlist their coordination in maintaining existing swales and ditches.

B. Inspect silt and straw bale fences at least once a week.

1. Immediately replace damaged portions of the silt fences, including portions which have collapsed, contain tears, have decomposed, or have become ineffective.

2. Remove sediment deposits, as necessary, to provide adequate sediment storage and to maintain the integrity of fences. Dispose of accumulated sediment by spreading over upland areas of the site.

C. Maintain erosion control devices in place, as specified, until completion of the work of this Contract.

1. At completion of work, inspect all systems, make necessary repairs, remove and dispose of all accumulated sediment, and turn completely operable systems over to Owner for continued maintenance.

D. Where necessary for equipment and vehicular access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.

E. Sedimentation Basins.

1. Contractor shall be responsible for maintaining the pond and the outfall and sediment retarding structure in good working condition throughout the time the pond is to be in operation.

2. When sediment and debris fill the pond to over one third (1/3) its designed capacity, the pond shall be cleaned out.

3. The sediment from the clearing operation shall be stockpiled with like materials per Specification 31 11 00 Clearing and Grubbing. If the material is found to not meet the stockpiling requirements listed in 31 11 00, they must be removed from the site as described in 31 11 00.

3.8 INSPECTIONS

A. Inspect all erosion control systems and devices at least once every seven calendar days.

B. Inspect all erosion control systems and devices within 24 hours of the end of any storm which results in precipitation of 1/2 inch or more.

C. During inspections, locations where stormwater leaves the site shall be inspected for evidence of erosion or sediment deposition.

D. Correct deficiencies within three calendar days.

E. Complete a report of each inspection. Report shall contain the following minimum information:

1. Inspector's name

2. Inspection date

3. Observations of the effectiveness of erosion control systems

4. Actions taken if necessary to correct deficiencies

5. Listing of areas where construction operations have permanently or temporarily stopped

6. Authorized signature

END OF SECTION 31 25 00

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. Installer/Applicator shall be licensed and specialize in termite control with minimum of five (5) years documented experience and approved by FBISD Design Manager and manufacturer of approved materials.

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 25 00 – Substitution Procedures**.

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. Treatment to extend 10’ beyond edge of building slab and 4’ under building slab.

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 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:
1. Section 013200 "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 015000 "Temporary Facilities and Controls" for temporary utilities and support facilities.
3. Section 312000 "Earth Moving"
4. Section 312319 "Dewatering" for dewatering system for excavations.

1.3. PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Monitor vibrations, settlements, and movements.

1.4. SUBMITTALS

A. Shop Drawings: For excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Other Informational Submittals:
1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

D. Note locations and capping depth of wells and well points.

1.5. PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify all impacted parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
   1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
   2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Identify benchmarks and record existing elevations.
   1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1. MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
   1. Corners: Site-fabricated mechanical interlock or roll-formed corner shape with continuous interlock.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

G. Tiebacks: Steel bars, ASTM A 722/A 722M.

H. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

A. **PREPARATION**

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

D. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

E. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

F. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2. SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3. SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4. TIEBACKS

A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
   1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
   2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5. BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6. REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
   2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
   3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 31 50 00

SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Dry-installed drilled piers.
2. Slurry displacement-installed drilled piers.
3. Dry-installed or slurry displacement-installed drilled piers at Contractor's choice.

1.3 UNIT PRICES

A. Unit prices are included in Section 01 22 00 "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.
1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

C. Trial Drilled Pier: Unit price as indicated for drilled pier, including backfilling.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.

D. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.

2. Admixtures.
3. Steel reinforcement and accessories.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

F. Field quality-control reports.

G. Other Informational Submittals:
1. Record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify all affected parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Refer Section 03 20 00.

2.2 CONCRETE MATERIALS

A. Refer Section 03 30 00 and Structural General Notes.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

B. Corrugated-Steel Pipe Casings: ASTM A 929, steel sheet, zinc coated.

2.4 CONCRETE MIXTURES

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.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Proportion normal-weight concrete mixture as follows:
1. As indicated in Structural General Notes.

2.5 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
   1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
   2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
   1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

G. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.

H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
   1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
   1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
   1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
   2. Vibrate top 60 inches of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
   1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Drilled piers.
   2. Excavation.

3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
3. Compression Test Specimens: ASTM C 31; one set of four standard 6-inch x 12-inch cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Levelness of bottom and adequacy of cleanout.
11. Ground-water conditions and water-infiltration rate, depth, and pumping.
12. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
14. Bell dimensions and variations from original design.
15. Date and time of starting and completing excavation.
16. Inspection report.
17. Condition of reinforcing steel and splices.
18. Position of reinforcing steel.
19. Concrete placing method, including elevation of consolidation and delays.
20. Elevation of concrete during removal of casings.
21. Locations of construction joints.
22. Concrete volume.
23. Concrete testing results.
24. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 01 90
OPERATION & MAINTENANCE OF PLANTING

PART 1 - GENERAL

1.1 SCOPE

A. Maintenance required under this contract shall conform to the specifications and criteria in this section. Items included in this section include, but are not limited to, the following:

1. Mowing, edging and trimming of lawn areas
2. Application of pesticides, as required
3. Weeding, cultivating and cleaning of all plantings
4. Application of herbicides
5. Adjustment of irrigation clocks for weather and growth conditions
6. General site cleanup - Removal of trash and products of maintenance
7. Hand watering of machine-transplanted trees
8. Truck watering of trees, turf, and shrubs via manual system

1.2 CONTRACT PERIOD

A. These specifications shall govern all maintenance work by the contractor on completed, partially completed, and area to be completed of the project. Maintenance shall be commencing at the Notice to Proceed and terminating at **90 days** (or as specified by owner) after the issuance of Notice of Substantial Completion.

1.3 INTENT OF CONTRACT

A. It is the intent of the contract to provide the owner with a project site that is attractive in appearance, and to keep all plant materials and lawns in a healthy and vigorous condition.

1.4 CONTRACTOR'S PERFORMANCE

A. The contractor shall perform all work as often as necessary to fulfill the spirit and intent of the contract. The workmen shall be neat in appearance, perform their work in a professional manner, keep noise to a minimum, and stage their work from a location on the site out of the way of the mainstream of the users. In general, the contractor's presence on the site shall be as inconspicuous as possible.

1.5 NEGLECT AND VANDALISM

A. Turf, shrubs, trees or plants that are damaged or killed due to contractor's operations, negligence, or chemicals shall be replaced at no expense to the owner.

B. Sprinklers or structures that are damaged due to the contractor's operation must be replaced by the contractor promptly.

C. All damage to, or thefts of landscape elements not caused or allowed by the contractor subsequent to the issuance of the Certificate of Substantial Completion shall be corrected by the contractor at the owner's expense, upon receipt of written authorization to proceed.

D. Damage due to thefts or vandalism prior to the date of the Certificate of Substantial Completion shall be at the contractor's expense.

1.6 EMERGENCIES

A. The contractor shall answer emergency or complaint calls regarding conditions in landscaped areas regarding fallen trees or branches, or shrubs or trees that obstruct the driveways, and shall correct the problem or place warning signs and advise the owner of the need for major work to be performed.

PART 2 - PRODUCTS

2.1 MACHINARY

A. Machinery requirements listed under this section are not intended to be restrictions of specific manufacturers or models unless so stated. Specific mention of manufacturers is intended as a guide to illustrate the final product of maintenance operations desired.

1. Lawn Mowers

    a. Shall be of the rotary-type, in good working order, finely turned to protect the lawn from excessive exhaust fumes.

    b. Blades shall be sharp, to reduce shredding of the cut grass.

2. Lawn Edgers

    a. Shall be of a rigid or flexible blade-type that will produce a fine, clean edge where lawns meet walkways, pavements, or curbs.

3. Fertilizer Spreaders

    a. Cyclone-type spreader, or equal.

    b. No visible under lapping of applications will be permitted.

4. Pruning Tools

    a. Shall be maintained in good working order.

    b. Cutting edges shall be sharp.

    c. Disinfect all tools when used for the removal of diseased limbs with a solution of Clorox and water, mixed at a 1:5 ratio.

5. Watering Truck & Pump

    a. Minimum 1200 gal. tank/pump.

    b. Pressure at nozzle: 35 PSI (1 1/2" outlet).

PART 3 - EXECUTION

3.1 GENERAL

A. All maintenance operations shall be performed by the contractor's own force, superintended by personnel familiar with the job. Subcontracting of maintenance work shall not be allowed.

B. Maintenance period shall commence immediately upon the issuance of the contract. It will be the contractor's sole responsibility to maintain plantings in original intended condition throughout the maintenance period of this contract.

C. Accidental damage to the landscape plantings beyond the control of the contractor shall be reported immediately to the owner.

3.2 IRRIGATION SYSTEM

A. Irrigation system maintenance shall generally be construed as any activity or activities necessary to keep the system 100% operational. Irrigation system maintenance shall include, but not be limited to:

1. Replacement of equipment damaged by contractor operations.

2. Repair of other equipment damaged or malfunctioning on a time and material basis.

3. Adjustment and cleaning of heads so as to correct miss directional throw, improper coverage and damage to equipment.

B. The contractor shall monitor and program the irrigation controllers to maintain optimum moisture levels in all planted areas.

C. Irrigation cycles shall be set to take place after 10:00 pm and prior to sunrise (4:00 am - 5:00 am), unless otherwise instructed by the owner, except during visits of grounds maintenance personnel. During such visits, the irrigation system may be operated as desired by those personnel

D. Irrigation cycles should gradually be reduced from September to the winter, in order to generally reduce late season plant growth and vigor, and to stimulate hardening off and dormancy of plant material.

3.3 STAKING AND GUYING

A. Contractor shall maintain staking and guying of trees at all times and shall be responsible for any damage to trees or plant materials caused by chafing or breaking of foliage or limbs coming in contact with stakes, ties, guys, eye bolts, or bracing materials. Periodically, adjust broken stakes and ties as needed. If ties are too tight, they must be replaced or adjusted. All labor and material costs shall be considered in base bid for time period up to Notice of Substantial Completion and / or completion of punch list items. Labor and material costs for post-Substantial Completion time period (approx. 30-90 days after Notice of Substantial Completion; time length to be determined by owner) shall be bid separately as a line item.

B. Trees and large shrubs that may require guys, stakes or special care during the winds and rains shall receive the required care prior to and immediately after anticipated and actual occurrences, to ensure that no damage results to the plant material.

3.4 PRUNING

A. Contractor shall prune regularly, as required. Remove dead wood and aesthetically balance the planting, as directed by the landscape architect. All suckers and undesired growth shall be removed immediately.

B. Do not prune limbs from trunks more than 12" above ground per 1" caliper (min. 8").

C. Pruning of shrubs should create a uniformly dense plant. Selectively thin and tip back annually. Prune to enhance natural branching effect of plants. Do not change shape of shrubs by pruning. Refer to schedule.

3.5 TURF MAINTINANCE

A. Mowing

1. During periods of cool weather, mow at one and one-half inches (1 1/2"), but during hot weather should not be lower than two inches (2") from the soil.

2. Regular weekly mowing is strongly recommended. Never scalp the lawn or cut more than one-third (1/3) of the existing top growth in one mowing.

3. Remove excessive clippings, never allowing clippings to remain on lawn surface for more than four (4) hours.

B. Watering

1. Provide a regular, deep watering program. The established turf should not be kept wet but should dry out under regular conditions. If it is hot or windy, water more often.

2. In very hot weather, a fast watering with fine spray will cool the turf zone and can supplement the regular deeper watering program.

3. In shaded areas caused by trees or shrubs, water more frequently because of the competition for soil moisture.

4. If lawn wilts (shows gray-brown), water more frequently.

C. In areas of new planting and lawns, allow new lawn to grow over tree ball. Maintain height of grass at tree trunk with hand clippers. Do not use weed whips around tree trunks.

3.6 MANUEL WATERING (QUICK COUPLER SYSTEM)

A. Water all plant material twice weekly or as necessary to maintain materials in thriving condition. Frequency may be reduced, as directed by the Landscape Architect during periods of wet weather.

container size	water quantity
65 gallon	30 gallons
30 gallon	16 gallons
15 gallon	10 gallons
10 gallon	7 gallons
5 gallon	4 gallons
3 gallon	2 gallons
1 gallon	2 gallons
Seedlings, 4” pot and plugs	½ gallon

3.7 GENERAL CLEANUP

A. The contractor shall dispose of all waste materials or refuse from his operations off the property, except where other arrangements have been made with the owner.

B. Keep all expansion and score joints free of any vegetation which may appear and apply appropriate herbicide to discourage future growth in these areas.

C. Leaves, papers, grass clippings or other debris shall be removed weekly, or at each visit from all areas.

D. Remove dead animals from the site immediately, as they are encountered.

PART 4 - SCHEDULE

4.1 GENERAL CLEANUP

A. The schedule as included herein shall be used as a guide for the work specified, which may fall within the post-construction maintenance period. Should the contractor require an alteration of the schedule, contact the landscape architect.

SCHEDULE

FUNCTIONS	FREQUENCY											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mowing	3	3	4	5	5	5	4	4	5	4	4	4
Edging	1	1	4	5	5	4	4	4	5	4	1	1
Debris Removal2	2	4	4	5	5	5	5	5	5	4	4	
Pruning		1								1		
Weed Control Beds			1	1	1	1	1	1	1	1	1	1
Clean/Sweep Curbs/Gutters	2	2	4	4	5	4	5	4	4	5	4	4
Overseed Rye									1*			
Index Irrigation 1	1	1	1	1	1	1	1	1	1	1	1	
Spray for Borers			1		1		1		1			

* Depending on Prevailing Weather

END OF SECTION

SECTION 32 13 13 - PORTLAND CEMENT CONCRETE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing, placing, curing and protecting Portland cement concrete paving, with or without reinforcement as indicated, constructed on a prepared subgrade.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute

   a. 301: Specifications for Structural Concrete for Buildings.

   b. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.

2. ASTM: American Society for Testing and Materials

   a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).

   b. C 150: Specification for Portland Cement Type I or Type II.

   c. C 309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

   d. C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

   e. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

   f. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).

   g. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

   h. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.

3. TxDOT: Texas Department of Transportation.

   a. Standard Specifications for Construction of Highways, Streets, and Bridges -- Latest Edition.

      1) Item 360, CONCRETE PAVEMENT.

B. Formwork Tolerances

Formwork tolerances shall be as specified in ACI 316 R, Chapter 5.

C. Finishing Tolerance

The top surface of pavement shall have a Class B tolerance as specified in ACI 316 R, Chapter 12.5 and ACI 301, Chapter 11.9.

D. The Portland Cement Paving Contractor/Subcontractor shall provide Owner with evidence of his/her ability to perform the specified work. This evidence shall be in the form of at least five (5) successfully completed Portland Cement paving projects.

This list of projects shall be submitted to Owner prior to any paving operations beginning so that Owner will be able to inspect the quality of workmanship at the site and approve the Contractor/Subcontractor.

1.3 SUBMITTALS

A. The following submittals shall be submitted:

1. Reinforcement Materials

   a. As required in Section 032100 - Concrete Reinforcement.

2. Concrete Materials

   a. As required in Section 321313.79 – Cast-in-Place Concrete.

3. Joint Materials

   a. As required in Section 321319 – Concrete Pavement Joints.

1.4 EXTENDED WARRANTY

A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation or failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit Owner's rights or remedies as may otherwise be afforded under law or statute.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Forms

Metal forms, as indicated in ACI 316 R, Chapter 5.

B. Welded Steel Wire Fabric
Plain wire fabric, as specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Reinforcing Steel Bars

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Dowel Bars
Smooth, ASTM A 615 + S1, Grade 60, new billet steel, coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

E. Dowel Bar Sleeves

Sleeves, PVC or plastic, slightly larger than dowel bars, closed end, a minimum of 6 in. long, with 1-1/2 in. long compressible insert.

F. Concrete

As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

G. Membrane Forming Curing Compound

ASTM C 309, Type 2, unless otherwise directed.

H. Joint Materials

1. Preformed Expansion Joint Filler: ASTM D 1751, ASTM D 1752, and D 1565.

2. Joint Sealing Material: See Section 321319, Concrete Pavement Joints of these Specifications.

I. Form Coating

Commercial formulation form-coating compounds that will neither bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces. Contractor shall submit sample for approval prior to use.

J. Precast Concrete Wheel Stops

Accurately formed and finished, of size and shape as indicated, reinforced and anchored as required. Fabricate wheel stops on Site or substitute approved precast units of like design and dimensions.

K. Epoxy Bonding Grout

ASTM C 881, Type I.

PART 3 – EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prepared subgrade shall be proof rolled to check for unstable areas and need for additional compaction. Do not begin paving work until such deficiencies have been corrected and subgrade is ready to receive paving.

B. Loose material shall be removed from the compacted subgrade immediately prior to placing concrete and subgrade shall be uniformly dampened.

3.2 SETTING FORMS

A. Forms shall be set in accordance with the recommendations of ACI 316 R, Chapter 5, and as specified herein.

B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement, and to ensure that forms shall remain in place not less than 24 hours.

C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 INSTALLATION OF JOINTS, REINFORCEMENT, AND SEALANT

A. Joints and reinforcement shall be installed in accordance with the recommendations of ACI 316 R, Chapter 6, as specified in Section 032100 - Concrete Reinforcement of these Specifications, and in Section 321319 - Concrete Pavement Joints.

B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 PLACING AND FINISHING CONCRETE

A. Concrete shall be placed and finished in accordance with the recommendations of ACI 316 R, Chapters 10 and 12.5, and as specified in Section 32 13 73.19 - Cast-in-Place Concrete of these Specifications.

3.5 CURING AND PROTECTING CONCRETE

A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.

B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by Owner.

3.6 INSTALLATION OF CONCRETE WHEEL STOPS

A. Install concrete wheel stops where indicated and in accordance with manufacturer's installation instructions as required. Where dowels are to be embedded into concrete, embed with epoxy bonding grout.

3.7 FIELD QUALITY CONTROL

A. Coring

After the pavement is placed and before final acceptance the Engineer may elect to determine pavement thickness by cores cut from the pavement or direct measurement of the edge thickness. Acceptable pavement thickness shall be deficient by no more than two tenths of an inch. Core holes shall be promptly repaired with concrete conforming to the requirements specified herein by the Contractor at no cost to Owner.

B. Deficient Pavement Price Adjustments

Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 0.75-inch, payment will be made at an adjusted price as specified in the following table.

Concrete Pavement Deficiency

Deficiency in Thickness Determined by Cores Inches	Proportional Part of Contract Price Allowed
0.00 to 0.20	100 percent
Over 0.20 to 0.30	80 percent
Over 0.30 to 0.40	72 percent
Over 0.40 to 0.50	68 percent
Over 0.50 to 0.75	57 percent

Any area of pavement found deficient in thickness by more than 0.75 of an inch but not more than one inch or 1/8 of the plan thickness, whichever is greater, shall be evaluated by the Engineer. If, in the judgment of the Engineer, the area of such deficiency should not be removed and replaced, there will be no payment for the area retained. If, in the judgment of the Engineer, the area of such deficiency warrants removal, the area shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness shown on the plans. Deficient pavement shall be removed for the full area of the slab between joints, or between pre-established limits.

END OF SECTION 32 13 13

SECTION 32 13 19 - CONCRETE PAVEMENT JOINTS

PART 1 – GENERAL

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. Unit Prices.

1. Payment for street pavement expansion joints, with or without load transfer, is on linear foot basis.

2. Payment for horizontal dowels is on a unit price basis for each horizontal dowel.

3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.

4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.

5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. 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 Section 01330 - Submittal Procedures.

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 – PRODUCTS

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. Conform joint sealants to one of sealant classes described in this section.

B. Conform hot-poured rubber-asphalt compound to ASTM D 3405.

C. Two-component Synthetic Polymer.

1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

2. Cure sufficiently at average temperature of 25 ± 1 C (77 ± 2 F) so as not to pick up under wheels of traffic in maximum three hours.

3. Performance requirements, when tested in accordance with TxDOT Tex- 525-C, shall meet above curing times and requirements as follows:

Cold-Extruded and Cold-Pourable (Self-Leveling) Specifications

Property	Requirement
Penetration, 25 C (77 F) 150 g Cone, 5 s, 0.1 mm (in.), maximum	130
Bond and Extension 50%, -29 C (-20 F), 3 cycles: *Dry Concrete Block *Steel blocks (Primed, if recommended by manufacturer) *Steel blocks shall be used when armor joints are specified	Pass Pass
Flow at 70 C (158 F)	None
Water content % by mass, maximum	5.0
Resilience: * Original sample, % min. (cured) * Oven-aged at 70 C (158 F), % min.	50 50
Cold-extruded material only - Cold Flow (10 minutes)	None

After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8 inch) deep in sealer or between sealer and test blocks.

4. Provide cold-extruded type for vertical or sloping joints.

5. Provide self-leveling type for horizontal joints.

D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant.

When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Self-Leveling, Low Modulus Silicone or Polyurethane Sealant	
Property	**Requirements**
Tack Free Time, 25 ± 1 C (77 ± 2 F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum
Tensile Strength and 24-Hour Extension Test: * Initial, 10-day cure, 25 ± 1 C (77 ± 2 F), kPa (psi) * After Water Immersion, kPa (psi) * After Heat Aging, kPa (psi) * After Cycling, -29 C (-20 F), 50%, 3 cycles, kPa (psi) * 24 Hour Extension	* 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * Pass (All Specimens) After 24 hours, there shall be no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

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 Project Manager.

PART 3 – EXECUTION

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 80 feet apart. 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 CONTRACTION 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.

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.

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 24 hours of concrete placement. Saw joints at required spacing 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.

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.

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 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

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.

3.10 JOINT SEALING

B. 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.

C. Use joint sealing equipment in like new working condition throughout joint sealing operation and be approved by Project Manager. 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.

D. 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.

E. 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

F. Maintain joints in good condition until completion of Work.

G. Replace damaged joints material with new material as required by this Section.

END OF SECTION 32 13 19

SECTION 32 16 13 - CONCRETE CURBS AND CURB AND GUTTER

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing, placing, curing, and protecting Portland cement concrete curbs, and combination curbs and gutters, constructed on a prepared subgrade.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute

   a. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.

2. ASTM: American Society for Testing and Materials

   a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).

   b. C 150: Specification for Portland Cement Type I or Type II.

   c. C 309: Specification for Liquid Membrane - Forming Compounds for Curing Concrete.

   d. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Closed Cell).

   e. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).

   f. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

   g. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.

3. FS: Federal Specifications and Standards

   a. TT-P-86: Paint, Red-Lead-Base, Ready-Mixed.

B. Finishing Tolerance

The top surface of curbs and combination curbs and gutters shall have a Class A tolerance as specified in ACI 316 R, Chapter 12.5.

1.3 SUBMITTALS

A. The following Submittals shall be submitted:

1. Reinforcement Materials

   a. As required in Section 032100 - Concrete Reinforcement of these Specifications.

2. Concrete Materials

   a. As required in Sections 321373.19 - Cast-in-Place Concrete of these Specifications.

1.4 EXTENDED WARRANTY

A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation and failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit LIT rights or remedies as may otherwise be afforded under law or statute.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms

Either wood or metal, of the size and shape necessary for forming the item, straight and free of warp.

B. Reinforcing Steel Bars

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Dowel Bars

Smooth, ASTM A 615 + S1, Grade 60, new billet steel, unbonded ends painted with red-lead-base paint, FS TT-P-86, Type I and coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

D. Dowel Bar Expansion Caps

PVC or plastic cap, slightly larger than dowel bar, closed end, a minimum of 6 in. long, with 1-1/2 in. long compressible insert.

E. Concrete

As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

F. Membrane Forming Curing Compound

ASTM C 309, Type 2, unless otherwise directed.

G. Joint Materials

1. Preformed Expansion Joint Filler: Nonextruding and resilient bituminous type, ASTM D 1751.

2. Joint Sealing Material: See Section 321373 of these Specifications.

H. Form Coating

Commercial formulation form-coating compound that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prepared subgrade shall be inspected for unstable or unsuitable areas and need for additional compaction. Notify the Engineer in writing of such deficiencies. Do not begin curb construction until all such deficiencies have been corrected.

B. Loose and foreign material shall be removed from the compacted subgrade immediately prior to placing concrete, and subgrade shall be uniformly dampened.

3.2 SETTING FORMS

A. Forms shall be set to the line and grade indicated and shall be securely staked to maintain set position during depositing and curing of concrete. The inside form shall be rigidly attached to the outside form.

B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement and to ensure that forms shall remain in place not less than 24 hours.

C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 INSTALLATION OF JOINTS, REINFORCEMENT, AND SEALANT

A. Reinforcement shall be installed as indicated on the Drawings and as specified in Section 032100 - Concrete Reinforcement of these Specifications. Joints shall be installed where indicated on the Drawings and in accordance with Section 321319 – Concrete Pavement Joints of these Specifications.

B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 PLACING AND FINISHING CONCRETE

A. Concrete shall be placed and finished as specified in Section 033053 - Cast-in-Place Concrete of these Specifications, and ACI 316 R, Chapters 10 and 12.5.

B. After concrete has been struck off and has sufficiently set, the exposed surfaces shall be worked with a wood float. The exposed edges shall be rounded using an edging tool.

C. After form removal, the surfaces of the curb or combination curb and gutter shall be plastered with a mortar consisting of one-part Portland Cement and two parts fine aggregate. Mortar shall be applied with a template constructed to the shape and dimensions of the item to be plastered. All exposed surfaces shall be brushed to a uniform smooth texture.

3.5 CURING AND PROTECTING CONCRETE

A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.

B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by the Engineer.

END OF SECTION 32 16 13

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SCOPE

A. This section gives requirements for playground area chain link fencing, gates and accessories.

1.2 RELATED WORK

A. Site Work.

1. Demolition in Division 2.

2. Concrete Construction for Structures in Division 32.

1.3 DESCRIPTION

A. Fencing has an overall height of 4’ for perimeter fencing of the playground area.

B. All fencing shall be galvanized.

1.4 SUBMITTALS

A. Shop Drawings. Submit in accordance with the paragraph on Shop Drawings in the Supplemental General Provisions. Submit drawings showing dimensioned layout of fence, details of fabric on gates, post and other components.

1.5 QUALITY ASSURANCE

A. Standards of Manufacture. Comply with standards of Chain Link Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and "Industrial Steel Specifications for Fence Posts, Gates and Accessories" as herein specified.

B. Acceptable Manufacturers. Furnish fencing, including gates, miscellaneous items and accessories of a chain link fence brand from a manufacturer listed, or an approved alternate.

1. Cyclone Fence Division, USX Corporation.

2. Anchor Fence Division, Anchor Post Products, Inc. of Texas.

1.6 HANDLING AND STORAGE

A. Cover and store materials above ground on platforms, skids or other supports protected from weather and mechanical damage.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

A. Fabric. Chain link fabric shall be galvanized conforming to ASTM-A392, Class 2. Fabric shall be woven from 9-gage wire in a 1-3/4 inch mesh. Fabric shall be knuckled at top and bottom selvage. Furnish one-piece fabric widths for fencing up to 12 feet high.

B. New Line Posts. Provide line posts of the following minimum sizes and weights of hot dipped galvanized steel, ASTM-A120, Schedule 40 with not less than 1.8 ounces zinc per square foot of surface. Maximum spacing shall be 10 feet c.c. unless otherwise noted.

1. Up to 6 foot fabric height, 1.90 inch O.D. steel pipe, 2.72 pounds per linear foot.

2. Six to 12 foot fabric height, 2.375 inch OD steel pipe, 3.65 pounds per linear foot.

C. Top, Middle and Brace Rails. Standard weight galvanized, 1.660 inch O.D. Steel pipe, 2.27 pounds per linear foot, with a minimum vertical bending strength of 202 pounds on 10 foot span conforming to ASTM-A120. Provide top rail couplings 6 inches minimum length spaced at 20 foot centers maximum. Provide 9 gage minimum fabric tie wire spaced at maximum 18 inch centers.

D. End, Corner and Pull Posts. Provide galvanized posts of the following minimum sizes and weights. Hot dipped galvanized steel shall be in accordance with ASTM-A120, Schedule 40 with not less than 1.8 ounces of zinc per square foot of surface.

1. Up to 6 foot fabric height 2.875 inch O.D. steel pipe, 5.79 pounds per linear foot.

2. Over 6 foot fabric height, 3.500 inch O.D. steel pipe, 7.58 pounds per linear foot.

E. Gate Posts. Provide standard weight ASTM-A120, Schedule 40 hot dipped galvanized steel pipe of the following size at each side of gate opening.

Leaf Width	Gate Post	Pounds per Linear Foot
Up to 6'	3-1/2" x 3-1/2" Roll-Formed Section or	4.85
	3.500 O.D. Pipe	7.58
Over 6' to 13'	4" O.D. Pipe	9.11
Over 13' to 18'	6-5/8" O.D. Pipe	18.97
Over 18'	8-5/8" O.D. Pipe	28.55

F. Gates.

1. Frames. Furnish 2 inch outside diameter galvanized pipe with pressed steel or malleable iron corner ells, securely riveted with four rivets per corner, or welded corners hot-dipped after fabrication.

2. Internal Bracing. Provide 1-5/8 inch outside diameter pipe and 3/8 inch adjustable truss rods.

3. Hardware. Conform to Federal Specification RR-F-183. Furnish a malleable iron ball and socket bottom hinge and a 180 degree wraparound-type top hinge to allow gate to swing 90 degrees or 180 degrees. Provide a padlocking device, center rests and semi-automatic catch to secure driveway gates in open position. Padlocks will not be provided by the Contractor.

G. Hog Rings. Use 9 gage galvanized hog rings to fasten fabric to bottom tension wires.

H. Fittings. All fittings shall be pressed steel or malleable iron and shall be hot-dip galvanized conforming to ASTM-153.

I. Stretcher Bars. Provide one bar for each gate and end post. Provide two bars for each corner post.

2.2 GALVANIZING

A. Fabric. Hot-dip galvanize after weaving. Provide sufficient coating to withstand 6 one-minute dips of Preece Test.

B. All Parts and Components Except Fabric. Hot-dip galvanized after fabrication of separate parts. Coat sufficiently to withstand 12 one-minute dips of Preece Test.

C. Testing by Contractor. Furnish the engineer with three copies each of the results of Preece Tests.

PART 3 EXECUTION

3.1 FENCE ERECTION

A. Erect the fence in accordance with approved shop drawings, manufacturer's instructions and this specification.

1. Posts.
   a. Space posts erect in line, not more than 10 feet on center.
   b. Setting. Set posts plumb in center of minimum 14 inch diameter footing with 4 foot minimum embedment for 6 foot fence and 6 foot minimum embedment for 10 foot fence. Hold post in place until concrete has set. Round or bevel top of footing to provide positive drainage away from post. Use Class "A" concrete for post foundation.
   c. Corner Bracing. Space midway between the top rail and the ground and extend to first line post. Fasten to the post with malleable iron or pressed steel connections and provide a truss rod from the first line post back to the end or corner post.

B. Gates, Top Rails, Bottom Rails, Stretcher Bars, and Miscellaneous and Accessory Items. Erect and install in accordance with approved shop drawings and manufacturer's recommendations.

C. Fabric. Install to clear top of concrete walks at all locations, but not to exceed 1 inch. Fasten to line posts with bands spaced approximately 14 inches apart. Attach to top and bottom rails with tie wires spaced approximately 18 inches apart. Attach fabric to gate end and corner posts by use of 1/4" x 3/4" tension bars laced to post every 14 inches with 11 gauge 1 inch wide steel bands and 3/8" diameter bolts and nuts.

END OF SECTION

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SCOPE

A. The work in this Section includes the installation of all materials specified herein and as shown on the contract drawings required to complete the irrigation system. Work shall include, but not be limited to:

1. Furnishing and installing a complete irrigation system.
2. Permit and fees as per **Fort Bend County** regulations.
3. Trenching and backfill.
4. Furnishing and installing backflow prevention devices.
5. Furnishing and installing sleeves where indicated.
6. Coordinate all activities with the installation of related electrical equipment and primary power wiring by electrical subcontractor.
7. Coordinating and installation of water meter and controller according to plans.
8. Boring under existing paving for irrigation piping and control valve wring if additional sleeves are required.
9. Inspections and tests.
10. Install extra control and ground wires if requested by Owners.
11. Clean up and disposal.
12. Coordinate connector of controller inside of building with other trades.
13. Record “As Built” drawings.
14. Warranties.

1.2 RELATED WORK

A. Costs for the following related items shall be part of the irrigation subcontract, unless otherwise specifically arranged for:

1. Contractor is required to obtain all necessary permits and pay all fees prior to any construction.
2. Water meters installation. *(if applicable)*
3. Electrification of controllers, including meters and disconnects.

1.3 RELATED SECTIONS

A. Operation & Maintenance of Planting: Section 32 01 90

B. Turf and Grasses: Section 32 92 00

C. Plants: Section 32 93 00

1.4 COORDINATION OF WORK

A. Contractor is to coordinate with other trades for construction sequence to avoid conflicts.

B. No portion of the irrigation system shall be installed until such time that all mechanical transplanting is complete.

1.5 INSPECTION OF SITE

A. The irrigation contractor shall inspect the site and become familiar with the conditions. Whereas additional site preparation is required prior to irrigation work begin, contractor shall coordinate his portion of the work with all other trades to minimize conflict. The irrigation contractor shall not mobilize his forces until the site is suitably prepared to facilitate the completion of all work in any given portion of the site. Beginning the work of this section without reporting unsuitable conditions to the landscape architect constitutes acceptance of conditions by the contractor. Any required removal, repair, or replacement of this work caused by unsuitable conditions shall be done at no additional cost to owner. Contractor shall take necessary precautions to protect site conditions. Should damage be incurred, this contractor shall repair damaged to its original condition or furnish and install equal replacement at his expense.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety, the Uniform Plumbing Code published by the Western Plumbing Officials' Association, and other applicable laws or regulations including the **City** plumbing code. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the contract document be at variance with the aforementioned rules and regulations, contractor shall notify landscape architect and get his instructions before proceeding with the work affected.

B. Furnish and maintain all warning signs, shoring, barricades, red lanterns, as required by the Safety Orders of the Division of Industrial Safety, and local ordinances.

C. Procure required permits and pay required fees for water meter taps and backflow devices.

D. Arrange inspections as required by local agencies and ordinances during the course of construction.

E. Irrigation in Texas is regulated by the Texas Commission on Environmental Quality (TCEQ) (MC-178) P.O. Box 13087 Austin TX, 78711-3087 www.tceq.state.tx.us

1.7 APPLICABLE STANDARDS

A. Current published standards, specifications, tests or recommended methods of trade, industry, or governmental organizations apply to work of this Section where cited by abbreviations noted below:

1. American Society of Testing and Materials (ASTM)

1.8 SUBMITTALS

A. At least ten (10) days prior to beginning work, submit five (5) copies of manufacturer's current cata- log cuts, specifications, and operating instructions of the complete list of materials and assemblies to be installed. Quantities of materials and equipment need not be included.

1.9 SUBSTITUTIONS

A. Specific reference to manufacturers' names and products specified in this section are used as standards. This implies no right to substitute other material or methods, without written approval of the landscape architect. No substitutions should be used as a basis for bid unless otherwise allowed and authorized by bid addendum, prior to receipt of bids.

1.10 SCHEDULING

A. If requested, contractor shall submit a proposed work schedule to landscape architect at least ten (10) days prior to start of work under this section. After approval, no delays shall be authorized to this schedule without written authorization by landscape architect.

B. The contractor shall complete all irrigation and related electrical work and have complete irrigation system installed prior to the commencement of any planting.

C. Upon approval from landscape architect, the contractor may be release of partial areas where irrigation is complete and automated for commencement of planting operations.

1.11 PRODUCT HANDLING

A. Protect work and materials under this section from damage during construction and storage. Protect pipes and fittings from direct sunlight. Beds on which pipe is stored shall be the full length of the pipes. Do not use any pipe or fitting which has been damaged or dented.

1.12 RECORD IRRIGATION DRAWINGS

A. Contractor shall furnish record drawings of the complete irrigation system, in accordance with the General Conditions. Procure from the landscape architect full-sized copies of contract drawings. Construction drawings shall be on the construction site at all times while the irrigation system is being installed. Contractor shall make a daily record of all work installed during each day.

B. Drawings shall show approved substitutions, if any, of material, including manufacturer's name and catalog number. The drawings shall be made to scale and all indications shall be neat. All information noted from the field shall be transferred to the drawings by contractor, and all indication shall be recorded in a neat, orderly way.

C. Final record drawings shall contain the following information:

1. Actual location of specified valves, added new valves, quick couplers, moisture sensor, rerouted lateral line locations, rain sensor and mini weather station. If requested by land- scape architect, provide dimensions from easily identified permanent features, such as buildings, curbs, fences, walks or property lines to each of the listed elements.

2. Each zone shall be outline with either thick marker or color pen. Each outlined zone must be properly label with zone number.

D. The record drawings shall be turned over to the owner and landscape architect before the final acceptance of the project.

1.13 IRRIGATOR LICENSE

A. All works in this section shall be performed under the direct supervision of a Texas licensed irrigator.

1.14 REVIEWS AND TESTS

A. The contractor shall test lines under hydrostatic (line) pressure for a 12-hour period and repair any leaks as required by the landscape architect.

B. Final review shall be made in conjunction with the final review of lawn, shrub and tree planting.

C. The contractor shall be responsible for making all repairs required to the irrigation system until the issuance of the Certificate of Substantial Completion. Upon the issuance of the Certificate, the owner shall assume responsibility for the repair and maintenance of the irrigation system.

D. All hydrostatic testing required in this section shall be at the contractor's expense, and part of this contract.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment to be installed shall be new and the best of their respective kinds.

2.2 RECLAIMED WATER

A. All materials and equipment components shall be purple in color if the irrigation system is designed to use reclaimed or rain water harvested water as a source of supply.

B. Contractor must follow state regulatory guidelines without exception.

C. Contractor is required to install minimum two 8” x 8” signs with “Caution Reclaimed Water Do Not Drink” verbiage in both English and Spanish at two quick coupler locations throughout the irrigated areas. Sign shall be at least 2 feet above finish grade.

D. Warning sign shall be made of metal. Metal sign plate shall be 8” x 8” x 1/16” thick with Pantone color #512 purple (or similar) background with stenciled in black warning reading as specified. Exposed post shall be painted with the same specified color purple.

2.3 PIPE

A. All pipes shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 degrees
F. and National Sanitation Foundation (N.S.F.) approval.

B. Piping on pressure side of irrigation control valves:

1. Three-inch (3") diameter and smaller, and all mains in sleeving Polyvinyl chloride (PVC) 1120-1220, and shall conform to ASTM #D-224.1-73

2. 3 inch (3") and larger: Polyvinyl chloride (PVC) 1120-1220 SDR 21.0, Class 200 rubber-gasketed pipe, conforming to ASTM D-1784 and ASTM D-2241. Rubber gasket shall con- form to ASTM D-1869 and shall be provided by the pipe manufacturer.

C. Piping on non-pressure side of irrigation control valves:

1. Polyvinyl chloride (PVC) 1120-1220, SDR 21, Class 200, and conforming to ASTM D-2241-73. Except one-half inch (1/2") diameter pipe shall be Class 315, SDR 135.

D. Backflow Devices

1. Type K - Copper pipe

2.4 FITTINGS

A. Fittings for Rubber-Gasketed Pipe

1. Connections at 3" and 4" mains to 3" and 4" mains or laterals shall be Schedule 80, as provided by the same manufacturer as the pipe, and conforming to ASTM D-2466 and ASTM D-1869.

2. Connections at 3" and 4" mains to 2 1/2" and smaller mains and laterals to remote-control and quick-coupling valves shall be Schedule 40 solvent-weld socket fittings conforming to ASTM-2466.

B. Fittings for Solvent-Welded Pipe

1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D-2466-73 and D-2467-73.

2. Threaded PVC nipples shall be Schedule 80 PVC.

3. Solvent glue shall be "Christy's Red Hot Blue Glue" with compatible primer.

C. Fittings for Polyethylene Pipe (Flex-Joints)

1. Polyalomer, as manufactured by "Flintkote" or approved equal.

2. Compression type of COVC, as manufactured by "Pepco" or equal.

D. Fittings for Sprinkler Swing Joints

1. Supply two (2) Schedule 40 "Marlex" street elbows and one (1) Schedule 40 thread-to-thread.

2. Threaded PVC Nipples shall be Schedule 80 PVC.

3. Lengths of nipples as shown on plans.

E. Fittings for Quick Coupler Swing Joints (Schedule 40)

1. Supply three (3) galvanized thread-to-thread elbows

2. Two (2) three inch (3") galvanized nipples

3. One two inch (2") threaded galvanized nipple

4. One twelve inch (12") threaded galvanized nipple

5. Use "Permatex" pipe compound for all threaded fittings

6. Eighteen-inch (18") #5 rebars

7. Two (2) stainless steel hose clamps

2.5 GATE VALVES

A. Up to three- inch (3"):125 lb. bronze construction, non-rising, as manufactured by "Grinnel", Red and White, or approved equal

2.6 SLEEVES FOR CONTROL WIRES AND WATER LINE

A. All conduits and sleeves for irrigation mains and laterals shall be six-inch (6") Schedule 40 PVC common conduit, unless indicated otherwise in the contract drawings. Use two-inch (2") Schedule 40 PVC for remote control wiring. For controller power feed, use 3/4" galvanized steel, un- less otherwise specified on the drawings or existing in the field.

2.7 CONTROL WIRE

A. Wire

1. Solid copper wire, U.L. approved for direct burial in ground.

2. Minimum gauge: #14 U.F.

3. Common ground wire shall be white.

B. Extra Wire

1. Supply a minimum of one (1) extra wire for each direction of run to last valve.

2. Extra wire shall be of a fugitive color, loop at each valve.

C. Splicing Material

1. All wiring splicing material shall be 3M DBY/DBR and DBY-6/DBR/6 Direct Bury Splice Kits.

2. All wire splice shall be placed in a 10” circular box.

2.8 VALVE BOXES

A. Valve boxes shall be injection-molded of polyesters and fibrous inorganic, temperature-resistant components. Box shall provide adequate clearance to operate and service valve. Box and lid to be green (purple if reclaimed water), as manufactured by Carson Industries, Inc., LaVerne, California or approved equal.

1. Electric Valve Boxes shall be rectangular, approximately ten inches by fourteen inches (10" x 14") and shall be approximately fifteen inches (15") deep. Model #1419-12 with

1419-2 hinged cover. Extensions for rectangular boxes shall be Carson #1419E-12 or Ametek or approved equal.

2. Gate Valve shall be round, approximately nine inches (9") inside diameter by ten inches (10") deep. Model #910-12. Extensions for round boxes shall be Carson #910E-12 or Ametek or approved equal.

2.9 QUICK-COUPLING VALVES / HOSE END CONNECTIONS

A. Valve and key shall **see plans legend for manufacturer and model**.

B. Hose connectors shall be NIBCO # or approved equal.

C. Furnish two (2) valve keys fitted with three-quarter inch (3/4") swivel hose ells.

D. Quick coupling valve box shall be 10"x14" to access ball valve easily.

E. All quick coupling valve caps shall be purple color as required by TCEQ regulations.

F. All quick coupling valve caps shall have a ball valve as required by TCEQ.

G. All quick coupling valve caps shall have a tag stating non potable water.

2.10 CONTROL WIRE SPLICE BOXES

A. Shall be ten inches (10") in diameter by ten inches (10") deep**. Rainbird or Owner approval equivalent.**

2.11 SPRINKLE HEADS

A. See plan legend for manufacturer and model.

B. Spray nozzles refer irrigation plans for details.

2.12 DRIP SYSTEM

A. See plans legend for manufacturer and model.

B. 1-inch Control Zone Kit: See plans legend for manufacturer and model.

2.13 REMOTE CONTROL VALVES

A. Valves shall be of plastic construction, slow acting **"Rainbird" ESP-LXME or approved equal**. Use PRS regulators where shown on plans.

2.14 REMOTE CONTROL TAGS

A. "Christy Irrigation I.D. Tags", yellow, with thermofused numbers with letter prefixes to match controller letters

2.15 VALVE KEYS

A. “Champion" #30, thirty inches (30") long, or approved equal. Furnish two (2) keys.

2.16 CONTROLLER

A. All controllers shall be positively grounded to a three-quarter inch (3/4") copper rod, driven a mini- mum of forty-two inches (42") into the ground. All units shall come equipped from the manufacturer with complete lighting and power surge protection.

B. See plans legend for Manufacturer and Model.

2.17 MOISTURE SENSOR (REFERENCE ONLY)

A. All moisture sensors shall be located within a 3’ diameter of the wire splice circular box so that they are easy to locate.

B. See plans legend for Manufacturer and Model.

2.18 CONCRETE FOR THRUST BLOCKS

A. Portland Cement

1. Shall conform to current requirements of ASTM Designation C150, Type I or IIcement.

B. Coarse Aggregate

1. Coarse aggregate for regular-weight concrete shall be hard, durable, uncoated, washed, graded, cleaned and screened crushed rock or gravel, conforming to current requirements of ASTM Designation C33.

C. Concrete shall be designated to surpass compressive strength of 3,000 psi.

2.19 GRAVEL BACKFILL

A. Gravel for backfilling quick-couplers, remote control valve boxes and rotor heads shall be three-eighths inch (3/8") diameter "pea gravel".

PART 3 - EXECUTION

3.1 LAYOUT

A. No consideration shall be given to any design changes until after the awarding of the contract. Should any changes be deemed necessary after award of contract for proper installation and operation of the system, such changes shall be negotiated by the landscape architect, based upon the price schedule.

B. Sprinkler heads shown on the drawings are diagrammatic. It shall be the Contractor's responsibility to establish the location of all sprinkler heads on all turf areas, in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.

C. The Contractor will stake out the location of each run of pipe and all sprinkler heads for sprinkler valve locations, prior to trenching. If any given area requires changes due to field conditions, contractor shall contact landscape architect for an alternative location. Do not re-

route without consulting landscape architect as it might create conflicts with other field elements. Proposed new location shall be approved by landscape architect prior to installation. Otherwise, it is contractor's sole responsibility for all relocation cost and at no cost to the owner.

3.2 PREPARATION

A. Generally, all piping under concrete and special paving shall be Schedule 40 PVC. Piping under concrete or asphalt shall be installed by boring. Where any cutting or breaking of sidewalks, concrete work and/or asphalt is necessary, it shall be removed and replaced by the contractor as part of this contract, in accordance with the owner and/or landscape architects' direction, at no cost to the owner. Where piping on the drawings is shown under paved areas but running parallel and adjacent to planted areas or turf areas, the intent of the drawings is to install the piping in the planted turf areas.

B. Unless otherwise specified or indicated on the drawings, the construction of the sprinkler system shall include the furnishing, installing, and testing of all mains, laterals, risers and fittings, the furnishing and installing of sprinkler heads, control valves and all necessary specialties and accessories, the removal and/or restoration of existing improvements, excavation and backfill, and all other work in accordance with the plans and specifications, as required for a complete system.

3.3 EXCAVATING AND TRENCHING

A. In areas where electrical conduit will be installed by the electrical contractor, coordinate all trenching activities with electrical subcontractor, so as to minimize duplication of work and/or damage to other's work.

B. Perform all excavations as required, for installation of work included under this section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, damaged or cut as a result of the excavations, to their original conditions.

C. The exact location of all existing utilities and structures and/or underground utilities, which may not be indicated on the drawings, shall be determined by the contractor and indicated on the "as built" drawings as they are encountered. The contractor shall conduct his work so as to prevent interruption of service or damage to them

D. In cases where existing underground utilities cannot be verified, it is contractor's responsibility to contact the proper agencies for a field location check.

E. The contractor shall protect existing structures and utility services and be responsible for their re- placement if damaged by him, or make necessary adjustments in their location if required, in order to complete the work of this contract. Minor adjustments in the system will be permitted to clear existing fixed obstructions, subject to the approval of the owner's representative or the landscape architect.

F. Trenches for plastic pipe shall be excavated of sufficient depth (12" to top of pipe) and width to permit handling and installation of the pipe and fittings. The backfill shall be thoroughly compacted by water tamping or approved method and evened off with the adjacent soil level. All trenches that are opened during any particular working day shall be closed and backfilled the same day. No open trenches or partially backfilled trenches shall be left overnight, except as required for inspection.

G. Trenches shall be of sufficient depth to provide minimum cover from finish grade, as follows:
1. Over pipe, on pressure side of irrigation control valve, control wires and quick coupling valves: twenty inches (20") minimum.

2. Over pipe, on non-pressure side of irrigation control valve: twelve inches (12”) typical.

3.4 BORING METHOD

A. All borings shall be performed with a water-lubricated rotary machine.

B. All bores shall be a minimum of eighteen inches (18") below any pavement, or at a depth required by governing code.

C. For bores greater than two inches (2"), a maximum pilot diameter of two inches (2") shall be used, with reamers for larger bores at a maximum of two-inch (2") increments.

D. Sleeves shall be immediately installed, as part of the boring operation.

E. Insert pull strings in sleeves as necessary.

F. Provide shoring, if required, to eliminate subsidence from under pavement structures.

G. Report any irregularities and obstructions in the boring process to the landscape architect for alternate route.

3.5 WATER METERS

A. Make required connections to water meter per the requirements of the local water authority codes.

3.6 BACKFLOW PREVENTION DEVICES

A. Install pressure-type backflow preventer at required grade for plumbing code. All exposed main line and main line riser above PVC main elevation, shall be type "K" copper. Install one (1) brass union in riser downstream, or device. Wrap all controllers with foam-type insulators.

B. See plans legend for Manufacturer and Model.

C. Backflow prevention devices shall be enclosed with metal enclosure as per detail.

D. Contractor shall provide inspection approval certificate from local agencies to owner and landscape architect before the final acceptance of this project.

3.7 LINE INSTALLATION

A. All pipe, fittings, and valves shall be carefully placed in the trenches. Interiors of pipe shall be kept free from dirt and debris. When pipe lying is not in progress, open ends of pipe shall be closed by approved means.

B. All lateral connections to the mainline, as well as all other connections shall be made to the side of the mainline pipe. No connections to the tip of the line shall be allowed. Pipes shall be bedded in at least two inches (2") of finely divided material with no rocks or clods over one-inch (1") diameter, to provide a uniform bearing. In common trenches, do not allow pipe to overlap.

C. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction, as recommended by the manufacturer.

D. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner as to ensure a square cut. Burrs at cut ends shall be removed prior to installation, so that a smooth, unobstructed flow will be obtained.

E. All plastic-to-plastic joints, except polyethylene, shall be solvent-weld joints or slip-seal joints.

F. Shall be made with plastic male adaptors.

3.8 SOLVENT-WELD JOINTS FOR PLASTIC PIPES

A. Thoroughly clean the mating pipe and fitting with a clean, dry cloth.

B. Apply a uniform coat of primer to the outside of the pipe and the fitting.

C. Apply a uniform coat of solvent to the outside of the pipe first, and then inside the fitting. Apply a second coat of solvent to the outside of the pipe, and quickly insert it into the fitting.

D. Give the pipe or fitting a quarter turn to ensure even distribution of the solvent, and make sure the pipe is inserted to the full depth of fitting socket.

E. Hold in position for fifteen (15) seconds.

F. Wipe off excess solvent that appears at the outer shoulder of the fitting. Care should be taken so as not to use an excess amount of solvent, causing an obstruction to form on the inside of the pipe. The joints shall be allowed to set at least twelve (12) hours.

G. Use "Permatex" pipe compound on the threaded PVC fittings, except where Marlex fittings are used.

H. Use strap-type friction wrench only. Do not use metal-jawed wrench.

I. When connection is plastic-to-metal, male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal, upon approval.

3.9 CONCRETE THRUST BLOCKS

A. Install where the rubber-gasketed irrigation main changes direction, as at ells and tees, and where the rubber-gasketed main terminates.

B. Pressure tests shall not be made for a period of thirty-six to forty-eight (36-48) hours following the completion of pouring the blocks.

C. Blocks for these mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications. Blocks shall be placed to take all thrust created by the maximum internal water pressure.

3.10 REMOTE CONTROL VALVES

A. Unless otherwise specified, the installation of all valves shall include the excavation and backfill, the furnishing, installing and testing of risers, fittings and valves, and the removal and/or restoration of existing improvements, and all other work, in accordance with the plans and specifications, and as required for the completed installation.

B. Valve installation shall include setting of the specified valve box to proposed grade. All valves shall be teed off the main, to facilitate setting at six inches (6") below grade, measured at the top of the handle.

C. Install control valves in valve boxes where shown, and group together, where practical. Place no closer than eighteen inches (18") to walk edges, buildings and walls. Valve boxes shall be flush with finished grade and fill ground with 3” to 4” of pea gravel. Set all remote control boxes in centerline of median for all esplanade applications.

D. Set valves in bead of four inches (4") of pea gravel, and fill to half of valve body.

3.11 SPRINKLER INSTALLATION

A. Sprinkler heads shown on the drawings are diagrammatic. In some cases, landscape architect may deem it is necessary to adjust or add spray heads in the field to improve coverage, avoid vertical elements, or spray patterns were infringes by plants. If such an adjustment and additional items are necessary and the works are relatively minor, contactor shall expect to make field changes with no cost to the owner.

B. All sprinkler heads and quick-coupling valves shall be set perpendicular to finished grade, unless otherwise designated on the drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas shall be set to grade no closer than eighteen inches (18") from such walls. Sprinkler heads which are to be installed in lawn areas where the turf is not yet established shall be set one-half inch (1/2") above the proposed finish grade.

C. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by the contractor as part of the original contract, with no additional cost to owner. All sprinklers having an adjusting screw shall be adjusted on a lateral line or circuit, as required, for the proper arc of cover- age, radius, diameter and/or gallonage discharge.

D. Backfill all rotor heads having drain holes in body with a minimum of one-half cubic foot (1/2 c.f.) of pea gravel.

E. After all new sprinkler piping and risers are in place and connected, and all necessary division work has been completed, and prior to the installation of sprinkler heads, all control valves shall be opened, and a full head of water used to flush out the system. The same procedures shall apply to the polyethylene tubing. Testing of the system shall be performed after completion of each section.

3.12 AUTOMATIC CONTROLLER

A. Install specified units in specified enclosures.

B. Install per local code and manufacturer's latest printed instructions.

C. Connect remote control valves to controller in clockwise sequence to correspond with station set- ting, beginning with stations 1, 2, 3 and so on.

D. All controllers shall be fully grounded and have full manufacturer-approved lightening protection.

E. It is contractor responsibility to coordinates with general contract to provide electricity to the vicinity of the controller. Contracts shall contract with a state licensed electrician to hook up power

to controllers. Hard wiring for controller is required. Under no circumstance controller to be connect to wall plug.

1. Wall plug connection for the controller can only be used as temporary electricity supply during construction if necessary, for test run. Once the system is fully operational, contractor shall rewire the controller immediately and connect to a permanent power supply by hard wire.

3.13 QUICK COUPLER

A. Pre-assemble quick coupler swing joint, using brass nipples and fittings as shown on details. Use Teflon tape for all threaded joints.

B. Discard nipples and fittings with damaged threads.

C. Test swing joint and quick coupler by pressuring to specified main line pressure. All joints should withstand pressure, while still being flexible.

D. Glue pre-assembled quick coupler and swing joint to main line and stack quick coupler, as shown.

E. Stake quick coupler assembly with specified rebar and two (2) hose clamps.

F. Install specified nine-inch (9") round box and pea gravel. Top of quick coupler shall be four inch (4") below top of box. Fill box with pea gravel to six inches (6") below top of box.

3.14 SPRINKLER SWING JOINTS

A. Install swing joints, as shown on drawings.

B. All joints shall be hand-tightened to eliminate leakage, but loose enough to remain flexible.

C. All pipe and fittings shall be oriented on either a horizontal or vertical access.

D. When complete, the heads should be fully adjustable.

E. Where possible, make all connections to the bottom of the sprinkler body. Avoid side connections, except for planter box applications.

F. All head height adjustment shall be made through the swing joint. When adjusted to grade, sufficient adjustment shall remain to facilitate raising or lowering at a later date.

3.15 CONTROL WIRES

A. Install control wires with sprinkler mains and laterals in common trenches, wherever possible. Lay to the side of pipe lines. Snake wires in trench, to allow for contraction of wires. Tie wires in bundles at ten foots (10') intervals with 3/4" black electrician tape.

B. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than five hundred feet (500'). Splice each connection in a separate "Scotchlock Sealing Pack". Place all splices in nine inches (9") diameter boxes.

C. Coil control wires and extra wires at each R.V.C. connection. Coil by neatly wrapping wire around a section of pipe, ten (10) wraps before splicing. Similarly coil all control wires at each end of all sleeves and where wire changes direction.

D. Install a minimum of one (1) extra control wire to the control valve located the greatest distance from the controller in each direction and label each blank end.

E. Pilot Wires to be red or black and white to be for all common ground wires.

3.16 GATE VALVES

A. Install isolation and branch gate valves directly on main.

B. Where gate valves isolate branch mains of a smaller size, size valve to largest main and add reducing fittings down stream of valves.

C. Place gate valve on minimum of four inches (4") of pea gravel. Place to cover pipe, while leaving handle fully exposed.

D. Install specified "Carson" box and "Carson" extension over valve. Box and extensions should extend from finished grade to top of pipe.

3.17 CONDUITS AND SLEEVES

A. Furnish and install conduit where control wires pass under or through curbs.

B. Conduits to be of adequate size to accommodate retrieval for repair of wiring and shall extend twenty-four inches (24") beyond edge of walls. Minimum size shall be four inches (4").

C. Install sleeves for all pipes passing through or under walls, walks, and paving. Sleeving to be of adequate size to accommodate retrieval for repair and wiring, or piping, and shall extend twelve inches (12") beyond edge of paving or other construction, where possible. Minimum size shall be six inches (6"). Refer to sleeving plan for location and sizes.

3.18 TESTING

A. Test piping on the non-pressure side of control valves after system is operational, by observing for leaks in pipe trenches.

B. Leaks resulting from tests shall be repaired, and tests repeated until system passes tests.

C. Completely install meter, mains, control valves and isolation valves.

D. Fill all lines with water and shut off at backflow.

E. Open all isolation valves.

F. Pressurize main to approximately 125 PSI. Monitor gauge for pressure for four (4) hours, with a maximum allowable loss of one (1) PSI per hour. Pressurize at quick coupler or fabricate a fitting for this purpose.

G. Repair any leaks or sources of pressure loss.

H. Test all isolation valves for leakage.

I. Perform above test prior to operation of laterals.

J. Laterals to be visually inspected for leaks during operation.

3.19 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95% density under pavements, 85% under planted areas.

C. Compact trenches in areas to be planted, by thoroughly flooding the backfill. Jetting process may be used on those areas.

D. Dress off all areas to finish grades.

3.20 CLEAN UP

A. Keep all areas of work clean, neat and orderly at all times. Keep paved areas clean during installation. Clean up and remove all debris from the entire work area to the satisfaction of owner and landscape architect prior to Final Acceptance.

3.21 EXTRA MATERIALS

A. The Contractor shall provide the following extra parts as part of this contract, prior to Final Acceptance.

ITEM	QUANTITY
Quick Couplers	2
Gate Valve Box	2
Quick Coupler Box Covers	2
R.C.V. Box	2
Sprinkler Heads	2 of each type used
Quick Coupler Keys	2
Thompson Keys	2
Valve Cover Keys	2 of each type used

3.22 WARRANTY

A. In addition to manufacturer's guarantees or warranties, all work shall be warranted for one (1) year from the date of Substantial Completion against defects in material, equipment and workmanship by the contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment, and workmanship, to the satisfaction of the owner. This shall not be interpreted to include damage caused by vandal- ism, accident or the result of activities by other parties.

B. The irrigation Contractor shall submit a letter of warranty, through the prime contractor, containing the following paragraph:

> "We hereby guarantee that the sprinkler irrigation system that we have furnished and installed is free from defects in materials and workmanship. The work has been completed in accordance with the drawings and specifications, ordinary wear and tear and/or unusual abuse or neglect, excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one year from the date of acceptance, and also to repair or replace any damage resulting from the

repairing or replacing of such defects at no additional cost to the owner. We shall make such repairs or replacements within a reasonable time, as determined by the owner, after receipt of replacements within a reasonable time, after receipt of written notice by Certified Mail from the owner, we authorize the owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand."

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

1.1 GENERAL

1.2 Work included in this Section shall include, but not be limited to, the following:

A. Project Layout

B. Preparation of existing rough grade for deposition of fine grading materials and turf

C. Cleanup and removal of debris and material, labor, tools, machinery and processes necessary to complete the above.

1.3 All work under this Contract not specifically designated on the drawings shall be field directed by the Owner or their Agent.

1.4 The use of any area for the purposes of equipment access, storage and employee parking shall be subject to the approval of the Owner or their Agent and in accordance with Division I. Prior to the start of any work, the Contractor shall submit a site plan clearly showing all access points, storage areas, employee parking areas and temporary facilities for approval by the Owner or their Agent.

1.5 WORK INCLUDED

A. Clearing and grubbing required for this Work includes, but is not necessarily limited to:

1. Felling of trees including removal of stumps, roots, and other debris.

2. Removing shrubs, grass, weeds, and other understory vegetation.

3. Removing improvements or obstructions that interfere with new construction.

4. Construction of temporary barriers around trees and/or tree save areas designated to remain.

5. Removal of all debris.

6. Siltation fence maintenance and installation.

PART 2 – MATERIALS

2.1 The Contractor shall submit an outline of methods, materials and machinery to be employed to complete work in this Section for approval.

2.2 HERBICIDE

A. Round Up or approved equal.

2.3 BARRICADES

A. 48" orange snow fencing or equal.

B. 5' metal "T" posts

2.4 SILTATION FENCING

A. 18" Mirafi 400 or equal.

PART 3 – EXECUTION

3.1 All work shall be performed under the direct supervision of the Contractor's designated superintendent. The above shall apply to all work, whether performed by the Contractor's own forces or sub-contractors.

3.2 SITE INSPECTION

A. The drawings do not purport to show all objects existing on the site.

B. Before commencing the work of this Section, verify with the Owner or their Agent all objects to be removed and all objects to be preserved.

C. Locate all existing utility lines and determine all requirements for disconnecting, abandonment, and capping. Assistance in the location of all existing utilities can be obtained from the Utility Coordinating Committee for Fort Bend County.

D. Locate all existing active utility lines traversing or adjacent to the site, and determine the requirements for their protection.

E. Attention is called to Division I requirements for protection of existing utilities and for reporting utilities not shown in plan.

3.3 REMOVAL OF DEBRIS

A. Remove all debris from the site and leave the site in a neat and orderly condition to the Approval of the Owner or their Agent.

B. All debris, the product of demolition, clearing, etc. unless otherwise designated, shall be removed from the site and legally disposed of. Such debris will not be allowed to accumulate so as not to constitute a hazard to the public.

C. Debris shall include all barricades or fencing and silt fencing upon completion of their intended use.

3.4 PREPARATION OF AREAS TO RECEIVE FILL MATERIAL

A. Treat all existing vegetative areas with Round Up and allow 7 - 10 days for effect.

B. Remove all dead vegetation.

C. Scarify top 4" of existing soil.

D. Apply till material.

3.5 TREE BARRICADE FENCING

A. Install 48" orange snow fencing continuously around all forested areas which are to remain undisturbed within the site as well as those isolated individual trees to remain.

B. Repair as necessary during the course of the work to keep areas free of intrusion by machinery, materials, equipment and workmen.

3.6 SILTATION FENCING

A. Install specified fencing at all curbs, property lines and edges of undisturbed forested areas to enclose the perimeter adjacent to all disturbed areas.

B. Fence shall be installed so as to prevent the migration of silt onto streets and adjacent properties and undisturbed forested areas.

3.7 CLEARING AND GRUBBING *(FOR REFERENCE ONLY)*

A. Felling of Trees

1. Protect roots and branches of trees designated to remain.

2. Remove only trees and shrubs within clearing areas designated on the drawings unless otherwise indicated or directed.

3. Completely remove stumps, root and other debris protruding through ground surface to a minimum depth of 12 inches.

4. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

B. Grubbing

1. Remove all surface rocks, stumps, roots and other vegetation within limits of construction to a minimum depth of 6".

2. Do not leave any roots greater than 3 inches in diameter in the ground.

3.8 STRIPPING TOPSOIL *(FOR REFERENCE ONLY)*

A. Strip to whatever depths encountered in such a manner to prevent intermingling with underlying subsoil or other objectionable material.

B. Remove heavy growths of vegetation from areas before stripping.

C. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance from trees to prevent damage to main root system.

D. Stock pile topsoil where directed.

E. Construction storage piles to freely drain surface water.

F. Cover storage piles if required to prevent windblown dust.

END OF SECTION

SECTION 32 91 14
PLANTING MEDIA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide materials, testing, equipment and labor required to prepare amended plant mediums for:

1. Planting Backfill Mix
2. Tree Planting Pit Backfill Mix
3. Shrub Bed Planting Backfill Mix

1.2 RELATED SECTION

A. Planting: Section 32 93 00

1.3 QUALITY ASSURANCE

A. If requested by owner, all soil components shall be tested by local or state testing laboratory for conformity to the specifications:

1. Contractor shall submit proposed laboratory name, address, and telephone numbers for approval.

B. For delivered material, test one grab sample for each 100 cy. of bulk material delivered to the site.

C. Excavated material from tree pits and shrub beds shall not be used for preparation of backfill mix.

1.4 SUBMITTALS

A. Contractor shall submit small bags of soil samples and mulch to landscape architect for approval prior to delivery to the job site.

B. Planting media mix data from manufacturer.

C. Manufacturer’s product data information.

1.5 INSPECTIONS

A. Testing will be at the expense of the contractor.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to site when permitted by the owner and only when project is ready for related work.

PART 2 – MATERIALS

2.1 ON SITE MATERIALS

A. Specified backfill mixes shall consist of like material to that used for landscape grading.

2.2 SOIL AMENDMENTS

A. Wood Residuals

1. Shall be naturally composted stockpiled, and not have been chemically treated.

2. Physical Properties

a. Grading:

U.S. Sieve	Dry Weight Percent Passing
3/8	100
1/4"	90-100
No. 8	70-100
No. 35	0-30

b. Organic Content by Ash Analysis: 90-100% Dry Weight

c. Chemistry

1) Saturation Extract

Conductivity (EDc): Nil-3.5

2) Reaction (pH): 3.0-5.5

d. Salinity

3) Maximum saturation extracts conductivity 1.0 milliohms per cm at 25 degrees centigrade.

B. Sand

1. Physical Properties

a. Grading:

U.S. Sieve	Percent Passing
No. 4	100
No. 10	95-100
No. 18	90-100
No. 35	65-100
No. 60	0-50
No. 140	0-20
No. 270	0-7

b. Chemistry:

Saturation

Extract
Conductivity (EDC): Nil-3.0

Sodium Absorption Ratio (SAR):	Nil-6.0
Boron-ppm in saturation extract sltn.:	Nil-1.0
Reaction (pH):	6.0-7.5
Available calcium-sodium acetate extractable-ppm dry weight:	Nil-2000

c. Iron Sulfate (Ferric or Ferrous)

1) Shall contain 30 to 35% iron, 35-40% Sulphur and be supplied by a commercial fertilizer supplier.

d. Treble Superphosphate

1) Commercial product containing 19 to 20% available phosphoric acid.

e. Urea Formaldehyde

1) Commercial product containing 38% Nitrogen

f. Soil Sulphur

1) Agricultural grade Sulphur containing a minimum of 96% Sulphur.

g. Ammonium Sulfate

1) Commercial product containing approximately 21% ammonia.

2.3 PLANTING MIX

A. Planting mix shall be thoroughly mixed in the following proportions:

1. Tree planting, shrub Bed, and planter backfill mixes:

a. Contain sandy loam topsoil

b. Double ground aged rice hull compost

c. #1 bank sand

d. Growers grade pine bark

e. Forest floor mulch (Black Humus)

f. All material is screened to provide 99% 1” minus sizing then blended to provide a uniform mixture. A minimum of 40% composted organic are utilized to add natural nutrients, provide aeration and optimum moisture retention capacities.

B. Actual mixes and additive may vary depending on samples extracted from actual plant sources.

C. Mulch shall be “Native Hardwood” mulch as supplied by Nature’s Way Resources, 101 Sherbrook Circle, Conroe, Texas 77385, 936-321-6990 or approved equal.

D. Prepared backfill mixes shall come from the following source or other reputable source:

1. Living Earth Technology, Houston, Texas (713) 466-7360 Select the branch that is closest to the job site

2. Nature's Way Resources, Conroe, Texas (936) 321-1200 101 Sherbrook Circle, Conroe, Texas 77385

3. Reputable local suppliers, contractor to submit venders for approval.

E. All shrubs beds shall receive one application of post planting fertilization with Microlife Ultimate (8-4-6) as supplied by San Jacinto Environmental Supplies, 2221 W 34th St., Houston, Texas 77018, 713.57.9090.or approved equal.

F. If root stimulator is required after planting, apply one application of "Super Seaweed" as supplied by San Jacinto Environmental Supplies, 2221 W 34th St., Houston, Texas 77018, 713.57.9090 or approved equal.

PART 3 - EXECUTION

3.1 MIXING

A. Mix soil base, amendments and chemical additives by mechanical means. Do not mix additives with excavated material at the plant pit site

B. Thoroughly mix all amendments in specified proportions prior to installation. Mix may be pre-blended or blended on site. Mix shall be approved by landscape architect prior to installation.

C. Soil and sand bases shall be completely pulverized and free of lumps or aggregated material. Moisture content of base materials shall not be such that chemical, granular or pelletized additives become dissolved during the mixing process.

D. Mix media in quantities of not less than 50 cubic yards or mix total quantity required, if less than 100 cubic yards. The Contractor shall be responsible for continuity between batches.

E. For soil media mixes, do not incorporate soil from mixing area with mix.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 - GENERAL

1.1 Work covered in this section shall include all materials, labor, equipment and supervision required for the installation of turf grass where and as described on the Drawings and in the Specifications. This work includes, but is not limited to the following:

A. Establishment of turf by sodding.

.

B. Installation of turf by the hydroseed method.

C. Site cleans up.

D. Maintenance and guarantee.

1.2 RELATED SECTIONS

A. Fine Grading: Section 31 22 16

B. Plants: Section 32 93 00

1.3 QUALITY ASSURANCE

A. Sod: Shall be subject to inspection and approval by landscape architect, owner or owner's representative at the site upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. The owner or owner's representative reserve the right to refuse inspection at this time is in his judgment; a sufficient quantity of sod is not available for inspection.

B. Seed: Owner or owner's representative shall be furnished a signed copy of statement from vendor, certifying that each container or bag of seed delivered is labeled in accordance with the Federal Seed Act and is at least equal to requirement previously specified. Seed analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be re-sampled and retested in accordance with latest rules and regulations under the Federal Seed Act at the discretion of the owner or owner's representative. If these tests reveal the seed to be below the specified pure live seed content, the contractor shall be required to plant additional seed to compensate for the deficiency at no cost to the owner.

C. The owner or owner's representative reserves the right to take or request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at contractor's expense. Cost of replacement of materials not meeting specifications shall be paid by the contractor.

1.4 INSPECTIONS

A. Make written request for inspection after seeding of sodding operation have been completed. Such inspection is for the purpose of establishing maintenance period.

B. Submit written requests for inspection to the landscape architect, owner or owner's representative at least 7 days prior to anticipate inspection date.

1.5 SUBMITTALS

A. Furnish required copies of manufacturers' literature, certifications, or laboratory analytical data for the following items:

1. Sod and seed source (certification).
2. Fiber mulch (laboratory analytical data)
3. Tank mix fertilizer (certification or laboratory analytical data)
4. Top dress fertilizer (certification)

PART 2 - MATERIALS

2.1 SEED

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers, unless exception is granted in writing by the owner representative. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

B. The minimum percentage by weight of pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Kind of Seed	Minimum % Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
Summer Mix		
Common Bermuda Grass (Hulled)	85	65
Apply between September-November and/or March-May		
Winter Mix		
Common Bermuda Grass (Un-Hulled)	85	65
Winter Rye	90	200
Apply between October-December only.		

Note: % Pure Live Seed = % Purity X % Germination = 100

2.2 Weed seed shall not exceed ten percent (10%) by weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weak seed will not be allowed.

2.3 FERTILIZER FOR TANK MIX

A. The additives shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warranty of the producer. Fertilizer to conform to following for 1,000 sf

20 lbs. (3-13-13) NPK for Turf

2.4 WOOD CELLULOSE FIBER MULCH

A. Wood cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed

in such a manner that it will not contain germination or growth-inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to 18% moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 lbs. and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

2.5 WATER

A. Shall be free from oil, acid, alkali, salt, and other substances harmful to growth of grass. The water source shall be subject to approval prior to use.

2.6 SLURRY MIX COMPONENTS PER ACRE

Wood Cellulose Fiber Mulch 2,000
Pounds of Grass Seed . . . . . .(as specified)
Fertilizer (13-13-13). . . . . 800 pounds

2.7 TOP DRESS AND LAWN FERTILIZER FOR EXISTING LAWN (DELAYED APPLICATION)

A. Complete fertilizer, fifty percent (50%) of the nitrogen to be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone, or tankage. Potash shall be derived from muriatic of potash containing sixty percent (60%) potash with elemental 20% iron sulfate equivalent to 400 lbs/acre:

16% Nitrogen
6% Phosphoric Acid
8% Potash

2.8 SOD

A. Sod shall be one (1) year old “419 Bermuda grass” (Cynodon dactylon). Sod shall be dense with grass having been mowed at one and one-inch (1") height before lifting from field. All sod delivered to the site for the duration of the project shall be uniformly cut by the same sod cutter or multiple machines adjusted to cut the same thickness of sod root/soil mass.

B. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects and grown on fumigated soil.

C. Do not stack for more than 24 hours between time of cutting and time of delivery.

D. The landscape architect reserves the right to reject any sod deemed unacceptable for installation.

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Prior to spreading topsoil for fine grading, contractor is required to remove any weeds that may had grown during the construction period by applying herbicide such as “Round Up” or approved equal.

    1. Till all areas to receive seeds prior to spraying herbicide. After applying the first round of herbicide, wait two weeks and reapply second round. Wait another week then bring top soil for fine grading.

B. Bed Preparation: Spread topsoil to a 2”-3” minimum depth required and feather smoothly into finished grade at edge so as to blend with adjacent ground shapes. Immediately after finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth.

C. The contractor shall apply seed, fertilizer and mulch by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified above.

D. Spraying Equipment: The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

    1. The spraying unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds per square inch. The pump shall be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipelines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

E. Homogeneously mix slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water.

    1. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. Nozzles or spray shall never be directed toward the ground in such a manner as might produce erosion or runoff. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The landscape architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

F. Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against miss and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area. Check on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets or paper or pans over the area at intervals and observing the quantity of material deposited thereon.

G. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

H. Keep hydromulch within areas designated and keep from contact with other plant material.

I. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

J. After application, the Contractor shall not operate any equipment over the covered area.

K. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean maintenance operations.

L. The contractor shall guarantee a good healthy stand of grass. Areas that fail to germinate within a reasonable period of time (3 to 4 weeks) shall be reseeded until healthy stands of grass are attained.

3.2 TOP DRESS FERTILIZER

A. Apply top dress fertilizer at the rate of six (6) pounds per 1,000 square feet at 21 days after seeding or sodding.

3.3 SODDING ON PREPARED FINISHED GRADE:

A. Do not commence sodding operation until irrigation system and fine grading are completed and verified by the landscape architect, owner or owner's representative.

B. Bed Preparation:

1. Remove any weed or other volunteer plant growth from lawn areas by tilling all areas to receive sod prior to spraying herbicide. After applying the first round of herbicide, wait two weeks and reapply second round. Wait another week then bring in top soil for fine grading.

2. Fine grade all lawn areas with a minimum application of 2"-3" top soil. Spread topsoil by hand raking, breaking up lumps and providing a smooth even friable bed. Fine grade topsoil so finish grade is 1" below adjacent tops of edging, curbs and walks. Limit fine grading to areas which can be planted immediately after grading. Where proposed sod meets existing lawn, cut grade at limit so top of new sod is even with existing grade.

3. Immediately after the finished grade has been approved, begin sodding operations to reduce excessive week growth. If soil is dry immediately prior to sod installation, dampen surface with a fine mist of water.

C. Installation:

1. Lay sod so that adjacent strips butt tightly with no spaces between strips. Sod joints shall butt evenly with no overlap. Discard sod with irregular edges, discolored, uneven thickness or insufficient topsoil. Lay sod on mounds and slopes with strips parallel to contours. Stagger joints. Sodded areas shall be flush with adjoining seeded areas.

2. Peg sod on slopes three to one or steeper with pegs driven through sod into soil until pegs are plush with turf. Space pegs 18 inches on center. Pegs to be one-inch (1") square by six inches (6") long pine or six-inch (6") lengths of lath or similar approved device.

3. Roll sod to eliminate any undulation or unevenness of finished grade.

4. Sod joint shall be top dressed with sharp sand. Reroll again to achieve an even uniform lawn.

5. Water sod thoroughly within 45 minutes of lying with water truck, firehouse or similar method to deliver quick application of water.

6. Trim all sod edges and planting bed edges by the end of the same day as adjacent sod is laid. Hand water trim pieces as above.

7. Immediately after installation of the sod, remove sod clumps and soil. Keep all areas clean during the maintenance period.

8. Sod shall not be laid on saturated wet or muddy ground, as it will creates deep undulation.

3.4 REPAIR OF EXISTING TURF

A. All areas within this contract not disturbed by construction or where repair of grade is not required shall be over seeded with a cyclone or equivalent type machine at one half the rate of the specified hydroseed mix.

B. Apply full rate of post seeding fertilizer as specified above.

3.5 MAINTENANCE BY THE CONTRACTOR

A. Maintenance under this contract shall commence immediately and include the care and periodical mowing as required to keep the site clean and presentable.

B. The contractor's maintenance period shall begin upon issuance of the Notice to Proceed and shall not be complete until final acceptance by the landscape architect, owner or owner’s representative.

C. The contractor's maintenance of new turf planting shall consist of watering, weeding, re- pair of all erosion and resodding as necessary to establish a uniform stand of specified grasses. Contractor shall guarantee growth and coverage of planting under this contract to the effect that all turf areas will be covered with specified planting after sixty (60) days with no bare spots greater than four (4) square feet. Any sod panels that are dead or dying shall be replaced.

D. Mowing shall be performed by the contractor during construction and per the agreed maintenance period after substantial completion. It shall be the owner’s responsibility after the agreed maintenance period.

E. The contractor shall not be held responsible for failures due to neglect by the owner, vandalism, or the act of god, during the guarantee period. Report such conditions to the landscape architect, owner or owner’s representative in writing.

3.6 FINAL ACCEPTANCE (END OF MAINTENANCE PERIOD)

A. Work under this section will be accepted by landscape architect upon satisfactory completion of all work, but exclusive of re-application under the guarantee period. Final Acceptance of lawn establishment shall be as follows:

B. Sod shall healthy, full and sod joints shall show minimal visibility.

C. Full coverage of all areas hydroseeded with full even coat of hydroseed mulch. Thin areas shall be reapplied.

D. Schedule overseeding operations with landscape architect, owner or owner’s representative for observation of method and confirmation of application and conformity to rates specified.

3.7 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to final acceptance to the satisfaction of landscape architect, owner or owner's representative

END OF SECTION

SECTION 32 92 13
HYDROMULCH SEEDING

PART 1 - GENERAL

1.1 SCOPE

A. Refer to the Drawings, Schedules and Details for type and locations of work required herein. Furnish all labor, materials, equipment and supervision for the installation of items included within these specifications. Such work includes, but is not limited to the following:
   1. Furnishing and applying hydromulch seeding including all materials and equipment required for the specified method of lawn installation.
   2. Site cleanup.
   3. Maintenance and guarantee.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:
   1. Texas Department of Transportation 2004 Standard Specifications for construction of Highways, Street and Bridges (TxDOT).
      a. Item 162 - Sodding for Erosion Control
      b. Item 164 - Seeding for Erosion Control

1.3 RELATED WORK

A. Section 31 22 13 - Site Grading.

B. Section 31 25 13 - Erosion and Sedimentation Control

C. Section 32 92 00 Turf and Grasses

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

1.5 SUBMITTALS

A. Samples:
   1. The Owner reserves the right to request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of replacement of materials not meeting the specifications shall be paid by Contractor.
   2. Typical requests from the owner may include copies of manufacturers’ literature, certifications, or laboratory analytical data for the following items:

a. Fibre Mulch.

b. Tank Mix Fertilizer.

c. Top Dress Fertilizer.

1.6 SCHEDULE

A. Submit a proposed work schedule to the Owner for approval at least fifteen (15) days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by the Owner.

B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.7 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. Submit written requests for inspections to the Landscape Architect at least seven (7) days prior to anticipated inspection date.

PART 2 - MATERIALS

2.1 SEED

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Landscape Architect. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage by weight or pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Kind of Seed	Minimum % Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
Bermuda Grass	85	7
K.R. Bluestem	85	1
Bahiagrass (Pensacola)	85	9

Note: % Pure Live Seed = (% Purity) X (% Germination)

B. Weed seed shall not exceed ten (10%) of weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.

C. Source - Quality Control

1. Seed: The Contractor must follow the Federal Seed Act with respect to interstate commerce and transportation. Each lot of seed may be re-sampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Owner. The seed retests will be conducted by a testing laboratory allowed by the State of Texas Department of Agriculture Seed Control Office. Material found to be below specified content levels will be at the contractor’s responsibility to correct by removing and replanting and/or additional plantings.

2.2 FERTILIZER FOR TANK MIX

A. Shall be 13-13-13 grade, pelleted, uniform on composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warrant of the producer.

2.3 WOOD CELLULOSE FIBER MULCH

A. Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination of growth inhibiting factors. It shall be dyed a green color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that meets all of the foregoing requirements.

2.4 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

1. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

2.5 SLURRY MIX COMPONENTS PER ACRE

A. Wood Cellulose Fiber Mulch = 2,000 pounds

B. Grass Seed = (as specified)

C. Fertilizer (13-13-13) = 800 pounds

2.6 TOP DRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:

1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Bed Preparation: Immediately after the finished grade has been approved, begin hydroseeding

operation to reduce excessive weed growth.

B. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Landscape Architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

C. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

D. Application:

1. Contractor shall obtain approval of hydromulch area preparation from the Landscape Architect prior to application.

2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

3. Keep hydromulch within areas designated and keep from contact with other plant material.

4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

5. After application, the Contractor shall not operate any equipment over the covered area.

6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.

7. Refer also to the maintenance portion of this section.

8. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall seed with required grasses or ground cover materials those areas missed by the hydromulch application. Method used to seed these missed surfaces shall be an alternate seeding operation approved by the Landscape Architect/Owner's Representative and shall be accomplished at no additional cost to the Owner.

3.2 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations. Clean up and removal all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Landscape Architect.

3.3 INSPECTIONS

A. Make written request for inspection prior to seeding and after areas have been seeded.

B. Submit requests for inspections to Landscape Architect at least two (2) days prior to the anticipated inspection date.

3.4 MAINTENANCE BY THE CONTRACTOR

A. The Contractor shall begin maintenance after each plant is installed and continue until Final Acceptance.

B. The Contractor's maintenance of new planting shall consist of watering, weeding, repair of all erosion and reseeding and re-sodding as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydromulch planting under this Contract to the effect that a minimum of ninety-five (95%) percent of the area planted will be covered with specified planting after sixty (60) days with no bare spots greater than ten (10) square feet. Any sod panels that are dead or dying shall be replaced.

C. The Contractor shall be responsible for one (1) mowing in the event that the time between seeding or sodding and Final Acceptance exceeds thirty (30) days.

D. Contractor shall make a second application of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Landscape Architect. Such replanting to be performed within sixty (60) days of initial application and immediately upon notification by Landscape Architect to replant.

E. Apply top dress fertilizer (16-6-8) at the rate of ten (10) pounds per 1,000 square feet at no less than nor more than twenty-five (25) days after seeding unless approved in writing by the Owner.

3.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work, but exclusive of re- application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

B. For Seed: Ninety-Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.

C. The Landscape Architect and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes specifications for furnishing and installing planting materials including:

1. Organic and chemical fertilizer

2. Mulch

3. Planting media and accessories

1.2 RELATED SECTIONS

A. Planting Irrigation: Section 32 84 00

B. Planting Media: Section 32 91 14

C. Turf and Grasses: Section 32 92 00

1.3 STANDARDS

A. American National Standards Institute (ANSI)/American Association of Nurserymen (AAN): ANSI Z60.1 1-069 "Nursery Stock".

B. "Grades and Standards", latest edition of Texas Association of Nurserymen Specifications, Austin, Texas 78704.

C. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by federal, state, and local authorities in furnishing, transporting, and installing materials.

1.4 QUALITY ASSURANCE

A. Installer: Installation of planting work shall be performed by a single firm specializing in landscape and planting work. Contractor shall be licensed by the Texas Association of Nurserymen, shall possess an agricultural certificate, shall be a licensed pest applicator, and shall have not less than 5 years of experience in this type of work.

B. Installer's field supervision: Require Installer to maintain an experienced full-time supervisor on project site when work is in progress.

1. Pesticide Applicator: State licensed for commercial work is required.

C. Compliance: Ship planting materials with Certificates of Inspection as required by governing authorities. Comply with all applicable local, state, and federal requirement regarding materials, methods of work, and disposal of excess and waste materials.

D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions or

disfigurement.

E. Analysis and Standards: All packaged products shall be delivered in original manufacturer's sealed containers. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1.5 MATERIAL INSPECTIONS

A. Plants shall be subject to inspection and approval by landscape architect upon delivery for conformity to specifications. Landscape architect may reject plant material that in his opinion does not conform to specifications. Submit a written or verbal request for inspection of plant material to landscape architect at least five (5) days prior to preferred date. The landscape architect reserves the right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection. The contractor shall submit alternate source for material if primary source of material deem unsatisfactory to meet specifications.

B. Substitutions of plant materials will not be permitted unless authorized in writing by landscape architect. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of contract price. Such proof shall be substantiated and submitted in writing to landscape architect at least thirty (30) days prior to start of work under this Section. These provisions shall not relieve contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

C. Contact landscape architect for inspection after planting operation has been completed. Such inspection is for the purpose of establishing the maintenance period.

D. Request for inspections to the landscape architect 5 working days prior to anticipate inspection date.

1.6 SUBMITTALS

A. Furnish required copies of photos of plant materials from their sources, manufacturers literature, samples, certifications, or laboratory analytical data for the following items:

1. Tree, shrubs and groundcovers (Samples and / or photographs)

2. Planting backfill mix (sample bag)

3. Mulch (manufacturer’s literature and samples)

4. Tree and shrub planting fertilizer (certification or laboratory analytical data)

5. Tree paint (manufacturer’s, literature)

6. Subdrainage materials (pipes, gravel, soil separator) *if applicable*

7. Geotextile Fabric *if applicable.*

1.7 PLANT MATERIAL DELIVERY, STORAGE AND HANDLING

A. The following considerations for product handling shall be evaluated:

1. During hot weather and when practical, the contractor may be required to transport plant materials between sunset and sunrise if transported in an open trailer or unrefrigerated van.

2. Dug material should be maintained and watered as required at the nursery to guarantee their vitality and health until shipping.

3. Protect from all damage trunks, stems, branches and root balls during tree tying, wrapping and loading operations.

4. Load containers onto transport vehicle and secure in a manner that protects the structural integrity of the root balls and branches.

5. The contractor shall be solely responsible for the safe transportation of plants to the site and their condition upon arrival. Trees damaged, dehydrated or abused during transit and storage will be rejected.

6. Plant materials should not be stored on concrete or left exposed to examples of climate without adequate protection.

7. Protect the root balls and water regularly until planting. If trees are left in storage over the weekend or holiday provide a means of periodical watering and inspection of container moisture.

8. B & B material shall be stored and maintained in a manner which affords protection from dehydration and damage of root ball. Root balls shall be wrapped and stored in mulch or approved containers.

B. The landscape architect may inspect any phase of this operation and may reject any plant material improperly handled during any point of this operation.

C. Nothing in this section shall be interpreted as relieving the contractor of his responsibility to provide healthy, viable plants, nor shall it have any affect upon the terms of the warranty specified herein.

1.8 INCIDENTAL REPAIRS

A. The landscape contractor shall coordinate repairs of damage to irrigation system incidental to the planting operation by either own forces or by irrigation subcontractor. Above repairs shall be made immediately so as to not interfere with the automatic cycling of the irrigation system. All repairs shall be permanent and include all flushing required to clean the lines of debris deposited by such damage.

B. Incidental damage to work by other subcontractors during landscape installation shall be made immediately and at no extra cost to the owner.

1.9 JOB CONDITIONS

A. Work Scheduling: Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.

B. Planting Time

1. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

2. Plant trees, shrubs and groundcover after final grades are established and prior to planting of lawns, unless otherwise directed by landscape architect or owner's representative in writing. If planting occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

C. Utilities: Refer to drawings and coordinate with utility contractor for location of utilities. Contractor shall be responsible for damage to existing utilities and structures.

D. Security: The owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project until project acceptance.

E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions beyond the scope of this contract, or obstructions, notify owner's representative of such conditions, immediately and before planting.

F. Pollution Control: Control dust caused by planting operations. Dampen surfaces as necessary. Comply with pollution control regulations of governing authorities.

PART 2 - MATERIALS

2.1 PLANTS

A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least 12 (twelve) months unless specifically otherwise authorized by landscape architect in writing. Unless specifically noted otherwise, all plants shall be heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.

B. Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

C. Plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if approved by landscape architect. Use of such plants shall not increase contract price. If larger plants are approved, the ball of earth or container size shall be increased as specified under “Applicable Standards” and subject to the approval of the landscape architect.

D. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on the trunk six inches (6") above natural ground four inches (4") in caliper and at a point twelve inches (12") above the natural ground line for trees over four inches (4") in caliper. If a range of size is given, no plant shall be less than the minimum size and not less than 40% of the plants shall be as large as the maximum size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

E. Container stock shall have grown in the containers in which delivered for at least six months, but not over two years. Samples must prove no root bound conditions exists. No container plants that have cracked or broken balls or earth when taken from container shall be planned. Container stock shall not be pruned before delivery. Field grown plants recently transplanted into containers will not be accepted.

F. Balled and burlap trees, when accepted, shall have a root ball size of ten (10X) times the caliper minimum.

1. Nursery grown B&B material shall be first pruned and thinned at the place of growth immediately prior to digging as required for packaging and safe moving. Method or pruning shall be as approved in the field by the landscape architect. Do not remove self-locking tags during this pruning prior to delivery to site. Final pruning shall take place at the site.

G. Trees which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sun scalds, disfiguring knots, or fresh cuts of limbs over 3/4 "which have not completely callused, will be rejected.

H. Method of pruning shall be as approved in the field by the landscape architect. Do not remove self-locking tags during this pruning prior to delivery to site. Final pruning shall take place at the site.

I. Plant Materials

1. Refer to landscape plans and plant schedule.

2.2 GUYING MATERIALS

A. The contractor shall use guying materials necessary to meet the requirements herein.

1. Pressure-treated 2" diameter lodge poles, "Wolman" treated, as provided by Bourbow Valley Company or approved equal. Contractor may use T-post only if prior approved by landscape architect.

2. Ties: Flexible strapping / Black rubber tire or another tie, as approved.

3. Tree Guying Material: Galvanized aircraft cable (7 x 19 GAC).

4. 12D Galvanized nails. *(if applicable)*

5. Hardware

a.	Guying cables:	7 x 19 aircord, size as specified.
b.	Turnbuckles:	galvanized or dip-painted, size as specified.
c.	2 holes crimping clamps:	galvanized or copper, size as required.
d.	Plastic guy covers:	3/8 "diameter x 3 'long white plastic tubing.

2.3 WATER

A. Furnished by owner. Transport as required.

2.4 PRE-EMERGENCE WEED CONTROL

A. All landscape and grass areas shall be treated with organic pre-emergent herbicide whenever possible. Application rate and timing shall be based on manufacturer’s recommendation.

B. If applying organic pre-emergent herbicide is not feasible, commercial chemical herbicide may be used with prior approval from landscape architect or owner’s representative. Application rate and timing shall be based on manufacturer’s recommendation. Treatment should be only applied by state licensed commercial applicator.

C. If necessary, contact herbicide may be use such as Roundup or approved equal. Do not exceed manufacturer's recommended rate of application. Treatment should be only applied by state licensed commercial applicator.

2.5 MULCH

A. Mulch for top dressing: Shall be organic mulch free from deleterious materials, debris and suitable for top dressing of trees, shrubs or ground covers. Mulch shall be the product of standard stripping of bark from pine, oak, or hardwood for fiber or pulp manufacturing with dark brown in color. Bark shall be shredded in a manner where large pieces are at a minimum.

B. Compost Mulch: Enriched bark mulch for bed prep shall be as above with additional organic of peat and/or manure.

2.6 PIPE FOR WATERING TUBE

A. Shall be perforated Polyvinyl Chloride pipe, Type (SDR 35), gray in color.

2.7 PLANTING MIX

A. See Planting Media: Section 32 91 14

2.8 FERTILIZER

A. Post planting fertilization shall be 100% organic.

1. Microlife or approved equal and apply at manufacturer's recommendation rate.

2.9 STEEL EDGING

A. Typical steel edging shall be 3/16” thickness by 4” height with 2.6 lbs/ft. unless indicated in the drawings.

B. Contract shall submit product data for approval prior to installation.

2.10 WEED BARRIER / GEOTEXTILE FABRIC

A. Typar #3401 terminally spunbonded polypropylene, non-woven, weed control fabric, 4.0 oz / lineal yard weight by American Excelsior or approved equal.

B. Contractor is required to submit samples and product data for approval prior to installation.

PART 3 - EXECUTION

3.1 LAYOUT AND EXCAVATION OF PLANTING AREAS

A. Layout plants in locations shown on drawings. Use wire stakes color-coded for each species of plant material or spray paint with nontoxic paint to delineate each plant species and outline bed locations. Each tree shall be staked for approval prior to planting.

B. The landscape architect will check location of plants in the field and shall adjust to exact position before planting begins.

C. If underground obstructions are encountered notify the landscape architect as to whether an adjustment or change of location is possible within the design intent. If the contractor is allowed to adjust or change location, rather than remove the obstruction, he shall make the change at no expense to the owner. Backfill and tamp abandoned pits have obstructions which cannot be removed.

3.2 EXCAVATION TO SUBGRADE FOR PLANTING AREA AND VERIFICATION OF FINISHED GRADE

A. Excavate all planting areas (pit and beds) to required depth as hereinafter specified and stockpile enough material to prepare planting mix for all plants. Remove excess material from site.

B. Verify that required grades are within two (2”) inches of required subgrade provided under a separate contract and excavate further as may be required.

C. Subsoil shall not be worked when moisture content is so great that excessive compaction will not occur, nor when it is so dry that clods will not break readily. Water shall be applied, if necessary, to bring soil to an optimum moisture content before tilling and planting.

D. Do not excavate tree pits more than 24 hours in advance of planting operation. Excavate container grown tree pits to the following dimensions:

Excavation for	Width	Depth
Boxed trees	Box + 24 in.	Ball + 6 in.
Container grown trees	Cont. + 18 in.	Ball + 6 in.
B&B trees	Ball + 12 in.	Ball + 6 in.
Container grown shrubs	Cont. + 12 in.	Ball + 4 in

1. Excavation for trees pits in areas of select fill (crushed and compacted limestone or similar) shall be twice as wide and twice as deep as given root ball. Fill bottom four inches of tree pit with gravel and cover with soil separator before backfilling pit.

E. Excavate shrub and ground cover beds to the following depths:

Excavation for	Width	Depth
Shrubs &	Entire Bed	Cont. + 4 in., not to be less than
Groundcover	Entire Bed	Cont. + 4 in., not less than 8 in

F. Rip or cultivates subgrade in pits and beds to a depth of three (3”) inches minimum.

3.3 DRAINAGE, DETRIMENTAL SOILS AND OBSTRUCTIONS

A. Test drainage of plant beds and pits by filling with water twice in succession. Conditions permitting the retention of water in planting beds for more than twenty-four (24) hours or percolation of less than one (1") inch per hour shall be brought to the attention of the Landscape Architect.

B. Notify the landscape architect of all soil or drainage conditions contractor considers detrimental to growth of plant material. (State condition and submit proposal and cost estimate for correcting condition.)

C. If rock, hardpan, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits and beds, alternate locations may be selected by landscape architect. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than six (6") inches below the required pit or bed depth. Proceed with work after approval.

3.4 PREPARING PLANT MATERIALS FOR PLANTING

A. Container grown stock shall be removed carefully and handled only by the root ball. Do not lift or handle container plants by tops, stems, or trunks at any time.

B. Do not bind or handle any plant with wire or rope at any time so as to damage bark or break branches. Lift and handle plants only from bottom of ball.

C. Balled and burlap (B&B) plants shall have firm balls of earth. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during planting operations. B&B material shall be dug only when dormant. Pre-dug stored B&B material shall be inspected and approved at the storage site.

3.5 INSTALLATION OF PIT PLANTED MATERIALS

A. Do not commence any planting until the irrigation system is completely automated or can be operated manually.

B. Fill plant pits with soil mix to compact depth to receive plant root ball, so top of root ball is two (2") inches above finished grade.

C. Install PVC watering tubes in tree pits, vertically, at edge of pit as shown.

D. Scarify the walls and bottom of all plant pits immediately prior to the placement of plant and backfill mix. The Contractor shall remove all glazing caused by an auger or mechanical hole digger.

E. For boxed & container grown material, break vertical bands and remove top and bottom of container. Carefully lower plant into pit with backhoe or approved method and adjust elevation. Cut horizontal banks and remove sides. Prune away girdled roots and tease root hair masses. Carefully fill pit and compact by watering in to support root ball.

F. Place B&B plants carefully in the prepared planting pit. Do not disturb root ball or untie twine or roping until backfill settlement is complete, and tree is staked, if applicable. Fill planting pit by flooding each eight (8") inches of backfill for balls greater than 24" diameter. Wrap trunks with double layer of tree wrap.

G. Smooth planted areas to conform to specified grades after full settlement has occurred. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of the landscape architect in writing.

H. Mulch circles shall not exceed width of root mass by more than 4". Mulch circles shall meet lawn or bed grades evenly and smoothly.

I. Water all plants immediately again after planting.

J. Apply pre-emergent weed control material in areas to receive mulch.

K. Spread mulch in required areas to the compacted depth of two (3") inches.

3.6 INSTALLATION OF BED PLANTED MATERIALS

A. Install steel edging where shown. Anchor with steel stakes spaced not more than three (3’) feet O.C. or as per often as necessary to have smooth radius or straight tangent. Drive stake to one (1”) inch below top of edging.

B. Fill all shrub and groundcover beds with plant bed mix to finished grade (compacted) plus two (2”) inches minimum.

C. Excavate in planting mix for individual plant and install as required. Set plant plumb and brace rigidly in position until planting soil mix has been tamped solidly around the ball and roots.

D. When plant pits have been backfilled approximately two-thirds (2/3) full, fertilizer per manufacturer'' recommendations at the maximum rate.

E. Water plant thoroughly, saturating root ball, before installing remainder of the planting soil to top of pit, eliminating all air pockets. Top of root ball shall be two (2”) inches above finished grade.

F. Smooth planting areas to conform to specified grade after full settlement has occurred. Contractor shall bear final responsibility for proper surface drainage of planting areas.

F. Water all plants immediately again after planting.

G. Apply pre-emergent weed control material over entire area to receive mulch.

H. Mulch all shrub and groundcover beds to three (3”) thick.

3.7 SURFACE DRAINAGE OF PLANTING AREAS

A. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of the landscape architect in writing.

3.8 POST PLANTING FERTILIZATION

A. Tree Planting

1. Apply fertilizer 30 - 45 days after installation.

2. Inject material specified in Section 2 with a high pressure injector into soil at depth and diameter shown below.

Tree Caliper	Application Points	Radius	Depth	Application Rate Per Tree
Under 2"	3	4" - 6"	16" - 18"	1-1/2
2" - 4"	3	4" - 6"	18" - 24"	2
4" - 5"	4	4" - 6"	2' - 3'	2-1/2
5" - 6"	5	4" - 6"	3' - 4'	3
Above 6"	3' 0. C.	4" - 6"		5 gal./100 sf Root Area (Drip Line)

3.9 PRUNING

A. Prune containerized plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Prune by removing entangled branching and by removing crotches. Avoid removing branch tips wherever possible. Pruning shall be done under supervision of the landscape architect.

B. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools.

C. Prune lower branching from trees to a height of 18" above ground per 1 1/4" caliper.

D. Prune B&B material in addition to place of growth as may be directed by landscape architect by removing a percentage of interior branching proportional to the root loss during digging (up to 1/3).

3.10 STAKING

A. The Contractor will be responsible for material remaining plumb and straight for all given conditions through the guarantee period. Tree support shall be done as outlined on the following tables and as illustrated on the details.

B. Trees should be staked during the same day as planting. Plants shall stand plumb after staking.

C. Stake all trees under 3 inches caliper in accordance with the following table:

Tree Caliper	Stakes	Length	Stake Size
To 1-3/4 in.	2	8'	Lodge/pole (2" dia)
2 in. to 3 in.	2	8'	Lodge/pole (2" dia)

3.11 GUYING

A. Guying shall be completed immediately after planting in accordance with the following table. Where manufactured product is specified, install per manufacturer's instructions. Plants shall stand plumb after guying.

B. Guy trees at points of branching with guys spaced equally around and outside perimeter of ball. Wrap rubber tire straps at points of contact with bark positioned at crotches and fasten to a deadman with specified cable with double crimp clamp. One turnbuckle shall be provided for each guy.

Tree Caliper at 12" Above Grade	No. Guys	Cable Size	Deadmen
3-1/4" to 4-1/2"	3	1/8" Dia. 7 x 7 Galvanized Steel Cable	Duck Bill Earth Anchor Model 68 DTS Kit
4-3/4" to 6"	3	1/8" Dia. 7 x 7 Galvanized Steel Cable	Duck Bill System Model 68 DTS Kit
6-1/4" to 8"	3	3/16" Dia.	Duck Bill System Model 88 DTS Kit

3.10 MAINTENANCE BY THE CONTRACTOR

A. The contractor shall begin maintenance after each plant is installed and continue until final acceptance.

B. The contractor's maintenance period shall begin upon inspection and approval at Substantial Completion and shall be for 90 days or to be determined by owner.

C. The contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repair of guys, resetting plants to proper grades or upright position, and furnishing and applying such pesticide sprays and invigorates as are necessary to keep the plantings free of insects and disease and in thriving condition.

D. Protect planting areas and plants at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protection barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by landscape architect at no additional cost to the owner.

3.11 FINAL ACCEPTANCE

A. Work under this section will be accepted by landscape architect upon satisfactory completion of all work, including maintenance, but exclusive of replacement of plant materials under the warranty period. Upon termination of maintenance period, the owner will assume responsibility for maintenance of the work.

3.12 WARRANTY

A. Planting shall be warranted by the contractor to remain alive and healthy for a period of 12 months after the date of Substantial Completion. Plants in an impaired, dead or dying condition after initial acceptance or within 12 months shall be removed and replaced. New planting and method of placing shall comply with the requirements of the specifications. Plants replacing those removed during the guarantee period shall also be guaranteed to remain alive and healthy for an additional 12 months after installation and acceptance.

B. Contractor shall not be held responsible for failure due to neglect by owner or property manager, vandalism, acts of god, during warranty Period. Report such conditions to the landscape architect or owner’s representative in writing when discovered.

C. Contractor shall indicate during Pre-Bid regarding warranty status of plant material in the case of no irrigation system provided in the project.

D. Submit a letter of warranty containing the following information:

1. "We hereby guarantee that the landscape planting we have furnished and installed is free from disease and in good condition, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted.

   We agree to repair or replace any defects in material or workmanship which may develop during the period of one (1) year from acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the owner. We shall make such repairs or replacements within a reasonable time, as determined by the owner, after receipt of written notice.

   In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the owner by certified mail, we authorize the

owner to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore, upon demand."

3.13 CLEAN UP

A. Clean up all areas as required for complete and acceptable inspection.

B. It is Contractor's responsibilities to replace or restore any damaged or disturbed areas during planting operation back to its original condition.

3.14 INSPECTIONS

A. Submit requests for inspections to the landscape architect at least five (5) days prior to anticipated inspection date.

END OF SECTION

SECTION 33 05 16 - UTILITY STRUCTURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Excavation and backfill.

B. Cast-in place concrete structures.

C. Precast concrete structures.

D. Metal components.

1.2 RELATED SECTIONS

A. Concrete formwork, concrete reinforcement, cast-in-place concrete, Portland cement concrete, concrete repair and finishing, and precast concrete are specified in the various Sections under Division 3 – Concrete and Division 33 – Exterior Improvements.

B. Interior trench drains and gratings for interior uses are specified in Section 05 50 00 - Metal Fabrication.

C. Duct banks are specified in Section 20 50 16 - Underground Ductwork and Structures for Facility Services.

1.3 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for utility structures will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for utility structures indicated in the Bid Schedule of the Bid Form.

B. Lump Sum: If the Bid Schedule indicates a lump sum for utility structures, the lump-sum method of measurement and payment will be in accordance with Division 00 – Procurement and Contracting Requirements.

C. Unit Price: If the Bid Schedule indicates a unit price for utility structures, the unit-price method of measurement and payment will be as follows:

1. Measurement:

a. Cast-in-place concrete and precast concrete units or structures and metal curb-and-gutter inlets will be measured for payment by the individual unit (each), installed in place. Each different type and size of concrete unit or structure will be measured separately for payment.

b. Manhole covers and frames, grates and frames, pipe inlets and outlets, manhole steps, ladders, miscellaneous metal, reinforcing steel, and grounding will not be measured separately for payment, but will be included as part of the utility structure to which it is attached or embedded.

c. Excavation and backfill for utility structures will be measured separately for payment as specified in Section 31 00 00 - Earthwork, as applicable.

2. Payment:

a. Utility structures will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1, herein.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A36/A36M Specification for Structural Steel
2. ASTM A48 Specification for Gray Iron Castings
3. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
4. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. ASTM A536 Specifications for Ductile Iron Castings
7. ASTM B3 Specification for Soft or Annealed Copper Wire
8. ASTM B26/B26M Specification for Aluminum-Alloy Sand Castings
9. ASTM C33 Specification for Concrete Aggregates
10. ASTM C150 Specification for Portland Cement
11. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
12. ASTM C270 Specification for Mortar for Unit Masonry
13. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
14. ASTM C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
15. ASTM C789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
16. ASTM C850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway Loadings
17. ASTM C858 Specification for Underground Precast Concrete Utility Structures

18. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures

B. Underwriters Laboratories Inc. (UL):

1. UL 467 Grounding and Bonding Equipment

1.5 SUBMITTALS

A. General: Refer to Division 00 – Procurement and Contracting Requirements for submittal requirements and procedures.

B. Shop Drawings: When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.

C. Product Data: Submit manufacturers' product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other, related miscellaneous metal items.

D. Certification: Submit certification or other acceptable evidence that covers and grates to be provided for roadways and parking areas meet proof-testing requirements for H2O and HS2O loadings in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

PART 2 – PRODUCTS

2.1 CAST-IN-PLACE CONCRETE STRUCTURES

A. Materials: Comply with requirements of Section 03 05 15 - Portland Cement Concrete, except as specified otherwise herein.

1. Portland Cement: ASTM C150, Type II, low alkali.

2. Cementitious Admixture: Provide fly ash or pozzolan conforming with ASTM C618, Class F or N, not to exceed 15 percent by weight of the cement content.

3. Aggregates: ASTM C33, fine aggregate and Size Nos. 56 or 57 (1-inch maximum size) coarse aggregate.

B. Mix Design: Obtain design of concrete mix as specified in Section 03 05 15 - Portland Cement Concrete, and incorporate the following requirements:

1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete, except that electrical structures, such as vaults, pull boxes, and concrete for ductbanks, shall be Class 3000.

2. Maximum water-cement plus pozzolan ratio: 0.45.

3. Maximum slump: 4 inches.

2.2 PRECAST CONCRETE STRUCTURES

A. General: The Contractor may provide precast concrete structures that conform to the general configuration, capacities, and inverts indicated.

B. Fabrication Standards: Comply with requirements of Section 03 40 00 - Precast Concrete, and ASTM C478, ASTM C789, ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.

C. Materials: Comply with requirements of Section 03 20 00 - Concrete Reinforcing, Section 03 05 15 - Portland Cement Concrete, and Section 03 40 00 - Precast Concrete, except as specified otherwise herein. Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.

D. Portland Cement Concrete: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete. Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.

1. Concrete for electrical utility structures shall be Class 3000.

E. Precast Covers: Precast covers shall have the utility identification, such as "PG&E Gas Valve," stamped into the cover.

F. Quality Control: In accordance with Section 01 45 00 - Quality Control, the Contractor shall perform such inspections and tests as required to verify compliance with these Specifications.

2.3 METAL COVERS, GRATES, AND INLETS

A. Ferrous Castings:

1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.

2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shotblasting.

3. Minimum tensile strength shall be 35,000 psi.

4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.

5. Where castings will be subjected to loads of H2O or greater, as indicated, provide ductile iron castings.

B. Aluminum Castings: Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi.

C. Manhole Covers: Provide cast, manufactured manhole covers and frames with heavy-duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.

D. Grates:

1. Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy-duty, bicycle safe inlet grates and frames of size and configuration indicated. Grates in roadways and

parking areas shall withstand H20 loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

2. Bar-Type Steel Grates: Refer to Section 05 50 00 - Metal Fabrications, for requirements. Bar-type steel gratings will be permitted only in areas where vehicular traffic will not be encountered.

E. Curb and Gutter Inlets: Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy-duty and bicycle-safe and shall withstand H20.

F. Cast Iron Manhole Steps: Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 12 inches on center in vertical alignment.

2.4 MISCELLANEOUS METAL

A. Requirements: Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.

B. Steel Materials: Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.

C. Anchors and Bolts: Conform with requirements of Section 05 50 00 - Metal Fabrications, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

D. Ladders: Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.

E. Grounding and Bonding Materials: Conform with UL 467 and the following requirements:

1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4-inch diameter by 10 feet long in size.

2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.

F. Fabrication: Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.

G. Galvanizing: All ferrous metal items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

2.5 MORTAR

A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the Texas Building Code, Chapter 21, Type S (without lime), with a minimum compressive strength at 28 days of 1,800 psi.

B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning, and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.

C. Use mortar within 90 minutes after mixing. Discard mortar that has been mixed longer or that has begun to set. Re-tempering of mortar will not be permitted.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Requirements: Construct manholes, junction chambers, catch basins, curb and gutter inlets, trench drains, culverts, headwalls, wingwalls, pull boxes, utility boxes and vaults, and related utility structures in connection with the installation of pipe, conduits, ductbanks, and utility trenches, as indicated.

B. Excavation and Backfill: Provide excavation, prepared subgrade and aggregate base, and backfill as specified in Section 31 00 00 – Earthwork and Section 33 05 28 - Trenching and Backfilling for Utilities, as indicated.

C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-In-Place Concrete.

D. Precast Concrete Structures: Install as indicated. Comply with applicable requirements of ASTM C891. Provide such appurtenances and installation accessories, including cement mortar and sealants, as required for a complete installation.

E. Metal Components: Install manhole covers, grates and frames, curb and gutter inlets, metal steps, ladders, channel inserts, pulling eyes, and electrical grounding rods as indicated and in accordance with the respective manufacturer's instructions. Covers and grates in roadways, parking areas, and concrete walks shall be installed flush with adjacent, abutting pavement.

3.2 FIELD QUALITY CONTROL

A. The Contractor shall perform slump tests and strength tests of cast-in-place structures in accordance with the requirements specified in Section 32 13 13 - Portland Cement Concrete Paving.

B. Acceptance of cast-in-place structures will be in accordance with Section 03-30-00, Cast-in-Place Concrete.

END OF SECTION 33 05 16

SECTION 33 05 28 - TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 – GENERAL

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. Unit Prices

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6-inches Over Excavation of Trench Bottom.

   a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.

   b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground and Surface Water.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. 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, fly ash, 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 Section 01578 - Control of Ground Water and Surface Water.

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.

3. 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 bedding.

Q. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation bedding is placed and compacted as backfill to provide stable support for bedding. Foundation bedding materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.

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.

V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.

W. Large Diameter Water Line (LDWL): Water line that is 24-inches in diameter or larger. X. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of emergency) and response procedure to a potential emergency condition associated with a large diameter water line.

Y. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved by project manager.

1.4 REFERENCES

A. ASTM A 798 – Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.

B. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipelines.

C. ASTM C 891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures

D. ASTM C 1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

E. ASTM C 1675 - Standard Practice for Installation of Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

F. ASTM C 1821 - Standard Practice for Installation of Underground Circular Precast Concrete Manhole Structures

G. ASTM D 558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.

H. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).

I. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

J. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

K. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classifications System).

L. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

N. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

O. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

P. TxDOT Tex-110-E - Particle Size Analysis of Soils.

Q. 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.

B. For proposed utility adjacent to or across existing LDWL:

1. Conduct a meeting between contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the EAP in the event a water line shut down becomes necessary.

2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.

3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.

4. Unless otherwise approved by County Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or County Holiday.

5. A County Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.

1.6 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:

1. Trench widths.

2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.

3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. 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.

F. Submit 11-inch by 17-inch or 12-inch by 18-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

G. For installation of proposed utility adjacent to or across existing LDWL, prepare and submit the following to Drinking Water Operations prior to beginning construction activities. Obtain approval from Drinking Water Operations prior to commencing prelocate or utility work near LDWL.

1. Trench details, shoring system designs, installation sequences, and flowable fill mix designs.

2. Emergency Action Plan (EAP) to address contingency plans in the event of damage to or failure of LDWL. Include the following:

a. Contact personnel and agencies including primary and secondary telephone numbers.

b. Contractor’s hierarchy of responsible personnel.

c. Traffic control measures.

d. Identification of resources to be available on or near project site in event of damage to or failure of LDWL.

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 Fort Bend County in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320 - Utility Backfill Materials.

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 premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 - PRODUCTS

2.01 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 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials and Section 02321 – Cement Stabilized Sand.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621 Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

PART 3 - EXECUTION

3.01 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, C 1479, or C 1675as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. 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 Section 02260 - Trench Safety Systems.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager 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 Section 02221 - Removing Existing Pavements, Structures,

Wood and Demolition Debris, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground and Surface Water. 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 Section 01725 - Field Surveying.

3.03 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. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.

2. Notify Project Manager 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 Project Manager 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 Project Manager with 48 hours notice prior to field excavation or relatedwork.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12-inch by 18-inch copy of Drawings. For large diameter water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

D. LDWL Prelocate Requirements:

1. Field-locate LDWL, appurtenances and laterals connected directly to LDWL through use of non-probing method such as a vacuum truck (non-water jetting method) at no greater than 50-foot intervals. Locate upstream and downstream of proposed work or utility installation.

2. Record crown and side of LDWL adjacent to proposed work or utility installation. Record LDWL locations horizontally and vertically using same coordinate system employed on proposed utility drawings.

3. Tie horizontal and vertical coordinates into project baseline. Submit recordings performed by R.P.L.S to County a minimum of 14 days prior to mobilizing to site.

3.04 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 Section 01562 - Tree and Plant Protection.

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, re-compact, and pave those areas at no additional cost to County.

E. Contingency plans for proposed work or utility installation adjacent to or across a LDWL:

1. Conduct on-site emergency drill prior to commencing proposed utility installation, and at three month intervals to assure EAP is current.

2. In the event a LDWL shut down becomes necessary, secure site and provide assistance to County personnel to access pipe and isolation valves as needed.

3.05 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.). Excavate trench so that pipe is centered in trench.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

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 Project Manager 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 Project Manager. 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 1 foot 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 Project Manager. 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.

L. Excavation and shoring requirements for proposed work or utility installation adjacent to or across a LDWL:

1. Identify LDWL area in field and barricade off from construction activities. Allow no construction related activities including, but not limited to, loading of dump trucks and material staging or storage, on top of LDWL.

2. Employ a groundwater control system when performing excavation activities within ten feet of LDWL to:

a. Effectively reduce hydrostatic pressure affecting excavations,

b. Develop substantially dry and stable subgrade for subsequent construction operations,

c. Prevent loss of fines, seepage, boils, quick condition or softening of foundation strata, and

d. Maintain stability of sides and bottom of excavations.

3. When edge of proposed trench or shoring is within a distance equal to one diameter of LDWL from outside of wall of LDWL, valve or appurtenance:

a. Maintain minimum of four (4) feet horizontal clearance and minimum of two (2) feet vertical clearance between proposed utility and LDWL.

b. Auger Construction

1) Maintain minimum of four (4) feet horizontal clearance between proposed utility and LDWL.

2) Dry auger method required when auger hole is 12-inches and larger in diameter.

c. Open Cut Construction and Auger pits

1) Perform hand excavation when within four (4) feet of LDWL.

2) Employ hydraulic or pneumatic shoring system. Do not use vibratory or impact driven shoring or piling.

3) Expose no more than 30-feet of trench prior to backfilling.

4) A maximum of one (1) foot of vertical trench shall be un-braced at a time to maintain constant pressure on face of excavated soil.

5) Upon removal of shoring system, inject flowable fill into void space left behind by shoring system. Comply with Standard Specification 02322 - Flowable Fill.

d. When edge of utility excavation is greater than one diameter of LDWL from outside wall of LDWL, use a shielding system as required by Project Manager and proposed utility standards and practices.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. 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 Section 02320 - Utility Backfill Materials.

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 Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 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 with approval by Project Manager. 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, when directed by Project Manager, in accordance with Paragraph 3.07.B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;

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 Section 01578 - Control of Ground and Surface Water.

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.

3.08 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.

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 lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. Adhere to the following subparagraph numbers 1 and 2.

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 Project Manager.

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.

K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand per paragraph 2. This provision does not apply to Storm Sewers constructed of HDPE pipe installed under pavement.

1. 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.

2. 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.

L. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill pipe embedment as specified in Section 02322 - Flowable Fill.

M. 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.

3.09 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.

B. For water lines, under pavement and to within one foot back of curb, use backfill materials described below:

1. For water lines 20-inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.

2. For water lines 24-inches in diameter and larger, backfill with suitable on-site material (random backfill) up to 12-inches below pavement base or subgrade. Place minimum of 12-inches of select backfill below pavement base or subgrade.

C. For sewer pipes (Storm and Sanitary), 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 for pipes of nominal sizes 36-inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42-inches in diameter and larger, under pavement or natural ground, backfill from 12-inches above top of pipe to 120 inches below pavement 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. For backfill materials reference Section 02320 - Utility Backfill Materials. This provision does not apply where a Storm Sewer is constructed of any flexible pipe product.

D. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill as specified in Section 02322 - Flowable Fill. For Storm Sewers constructed of any flexible pipe product and not installed under pavement provide cement stabilized sand.

E. 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 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.

F. Unless otherwise shown on Drawings. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

1. Class I, II, or III or combination thereof:

a. Place in maximum 12-inch thick loose layers.

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 above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.

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. Class IVA and IVB (Clay Soils):

a. Place in maximum 8-inch thick loose lifts.

b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone. This provision does not apply to flexible pipe used for storm sewers.

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 any additional cost to County, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.

2. Maximum 9-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, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section

B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12-inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench.

Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to County.

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 Project Manager.

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 Project Manager, 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, outer 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, re-compact, 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 Section 01576 - Waste Material Disposal.

END OF SECTION 33 05 28

SECTION 33 11 00 - WATER DISTRIBUTION SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Buried pipe and fitting.

B. Valves.

C. Fire hydrants.

D. Thrust blocks and harnessing.

E. Field quality control.

F. Test.

G. System disinfection.

H. Connections to existing mains.

1.2 RELATED SECTIONS

A. Trenching, bedding, and backfilling for pipelines are specified in Section 33 05 28 - Trenching and Backfilling for Utilities.

1.3 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for the water distribution system will be either by the lump- sum method or by the unit-price method as determined by the listing of the bid item for the water distribution system indicated in the Bid Schedule of the Bid Form.

B. Lump sum: If the Bid Schedule indicates a lump sum for the water distribution system, the lump- sum method of measurement and payment will be in accordance with Section 01 20 00 Price and Payment Procedures, Article 1.03.

C. Unit price: If the Bid Schedule indicates a unit price for the water distribution system, the unit- price method of measurement and payment will be as follows:

1. Measurement:

a. Water distribution system will be measured for payment by the linear foot of pipe, installed in place, tested and disinfected, for each type and size of pipe, along the centerline of the pipe with deductions made for manholes or other structures, measured from the inside face of each structure.

b. Utility structures will be measured separately for payment as specified in Section 33 05 16, Utility Structures.

c. Pipe fittings, valves, joints, pipe bedding, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.

d. Fire hydrants will be measured for payment by the individual unit (each), installed in place and acceptably tested.

e. Support of trench excavation, maintenance, support of existing utility facilities, grading, excavation and backfill, cast-in-place concrete, and incidental work pertaining to the installation of pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for pipe.

2. Payment: The water distribution system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM A126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
2.	ASTM A197	Specification for Cupola Malleable Iron
3.	ASTM A307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
4.	ASTM D1784	Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
5.	ASTM D1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
6.	ASTM D2466	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
7.	ASTM D2564	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
8.	ASTM D2855	Practice for Making Solvent-Cemented Joints, with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
9.	ASTM D3139	Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
10.	ASTM F439	Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
11.	ASTM F477	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA):

1.	AWWA C500	Gate Valve, 3 through 48 inches NPS – for Water and Sewage System

2.	AWWA C503	Standard for Wet-Barrel Fire Hydrants
3.	AWWA C504	Rubber Seated Butterfly Valve
4.	AWWA C508	Swing-Check Valves for Water Works Service, 2 inches through 24 inches NPS
5.	AWWA C606	Grooved and Shouldered Type Joints
6.	ANSI/AWWA	Standard for Disinfecting Water Mains C651
7.	ANSI/AWWA	Specification for Polyvinyl Chloride (PVC) Pressure Pipe, C900 4 in. through 12 in. for Water Distribution

C. Water Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional water utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

D. Underwriters Laboratories Inc. (UL):

1.	UL 246	Hydrant for Fire-Protection Service

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Submit respective manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.

C. Submit Shop Drawings showing piping layout and pipe, valves, hydrants, and locations of tie-ins, buttresses, and thrust blocks.

1.6 SUBMITTALS FOR CLOSEOUT

A. General: Refer to Section 01 77 00 - Closeout Procedures, and Section 01 78 23 - Operation and Maintenance Data, for submittal requirements and procedures.

B. Record Drawings: Record actual location of piping mains, valves, connections, and invert elevations for review.

1.7 SITE CONDITIONS

A. Excavations in which products will be buried shall be dry.

B. Coordinate the installation of the water supply system with the jurisdictional water utility owner.

C. The jurisdictional water utility district shall provide water services to the water meters' points of connection for station facilities and landscape irrigation systems, and modifications to existing water mains, as indicated on the Contract Drawings. The Contractor shall be responsible for making all such arrangements.

PART 2 – PRODUCTS

2.1 BURIED PIPE AND FITTINGS

A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated.

B. PVC Pipe and Fittings, 3 Inches and Smaller:

1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1.

2. Fittings: ASTM D2466, socket weld, same material and schedule as pipe, or meeting requirements of ASTM F439, as applicable.

3. Joints: Socket welded with PVC solvent cement conforming to ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

1. Pipe: AWWA C900, Class 200, polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.

2. Fittings: ASTM D1784, Type 1, Grade 1, polyvinyl chloride (PVC) fittings, Class 200, or meeting requirements of ASTM F439, as applicable.

3. Joints: ASTM D3139, gasketed bell joints with ASTM F477 gaskets.

2.2 VALVES

A. Gate Valves:

1. Gate Valves up to 2-1/2 Inches: 150-pound bronze body, non-rising stem, single wedge, threaded connection.

2. Gate Valve 3 Inches and Over: AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends with type gland and serration's designed for plastic pipe service.

B. Pressure Reducing Valves: All bronze construction, spring-loaded, single-seated, suitable for tight shutoff under dead-end conditions. Provide with renewable composition seat discs, nylon inserted diaphragm, bolted spring chamber, and threaded connection.

C. Backflow Preventer: Provide a device that is approved by the jurisdictional water utility company. As a minimum, the backflow preventer shall be a reduced pressure principle assembly with two rising- stem gate shut-off valves, two resilient seat ball-valve test cocks, two check valves replaceable resilient disks and seat with relief valve with replaceable seat. Backflow preventer shall be suitable for 175 psig operating pressure and 140 degrees F operating temperature, and shall be of bronze construction with bronze internal parts and stainless steel springs, screwed inlet and outlet for 2-inch and smaller sizes, and cast iron, epoxy- coated construction with 150 pound flanged inlet and outlet for 3-inch and larger sizes.

2.3 FIRE HYDRANTS

A. Provide fire hydrants and related appurtenances as indicated. Fire hydrants shall comply with the requirements of the jurisdictional authority and the standard drawings and specifications of the

jurisdictional water utility district, as applicable.

B. Fire hydrants shall meet the requirements of AWWA C502 and UL 246, as applicable, and shall be wet barrel type, as a minimum, with a minimum of two discharge nozzles of size(s) required by the jurisdictional authority.

2.4 CONCRETE FOR THRUST BLOCKS

A. Provide Class 3000, 1-inch aggregate, concrete for all thrust blocks, as specified in Section 03 05 15 - Portland Cement Concrete, with reinforcement where indicated.

2.5 MISCELLANEOUS METAL

A. Tie Rods: Stainless steel, Type 316, threaded ANSI standard, bolt threaded on both ends. Minimum 1/2-inch diameter for 4-inch pipe, 5/8-inch minimum diameter for 6-inch and 8-inch diameter pipe, and 3/4-inch minimum diameter for 12-inch and larger.

B. Rod Couplings: Malleable iron, ASTM A197, turnbuckle design, female threaded to mate with tie rods, 5/8-inch and 3/4-inch sizes to mate with both rods and mechanical joint bolts.

C. Pipe Clamps: For sizes 4 inches and larger, provide with malleable iron rod sockets. Provide washers in lieu of rod sockets where authorized, conforming with ASTM A126, Class A, cast iron. Bolts and bolting shall conform with ASTM A307.

PART 3 - EXECUTION

3.1 MAINTAINING WATER SERVICES

A. Maintain water service and conduct operations at times selected to minimize the duration and inconvenience of service interruption.

B. At least 24 hours prior to the required cutting or abandoning of an existing water main, notify the jurisdictional water utility owner, and obtain approval of the schedule. Actual cutting or abandoning of an existing water main shall be performed by the Contractor after receiving approval from the owner of the facility.

C. Keep existing water mains parallel to new water mains in service until new water mains are ready for service.

D. Where the existing water main or service is to be cut for connection to new piping, the work shall be performed by the Contractor. Initial work operations shall include the test-pitting of all points of connection (tie-in) to ensure the true location of existing linework.

E. Water valves in service shall be operated only by personnel of the jurisdictional water utility owner.

F. Except as specified otherwise herein, construction methods shall be in accordance with the applicable provisions of the jurisdictional water utility owner's standard drawings and specifications.

3.2 INSTALLATION

A. Installation Requirements:

1. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand trim bottom of trench to approximately 6 inches below invert of pipe.

2. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.

3. Place sand bedding material, meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.

4. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.

5. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.

6. Maintain optimum moisture content of bedding material to attain required compaction density.

7. Provide concrete thrust blocks for elbows, tees, valves, and appurtenances of buried piping. Thrust blocks shall be constructed as indicated and in accordance with AWWA requirements.

8. Install piping true to line and grade, supported and guided to assure alignment under all conditions.
9. Install pipe to allow for expansion and contraction without stressing pipe or joints.

10. Install unions at each connection to valves, both sides of each valve.

11. Make change in line with fittings. Do not spring joints to effect change of direction.

12. Do not field cut pipe unless necessary. Make such necessary cuts by means of equipment designed for the purpose, ensuring a smooth and square end.

13. For connection to existing pipe, provide pipe with suitable ends or adapters, after verification of size and type of existing pipe.
14. Install tie rods and pipe clamps at every joint fitting and valve.

B. Valves:

1. Install valves in accordance with the valve manufacturer's installation instructions.

2. Where valves are provided by the jurisdictional water utility owner, provide suitable access for performance of such work.

3. Where necessary, alter the typical valve manhole to suit actual conditions. Any alterations in valve manholes shall be operable from the street level. All operator nuts shall be plumb to the valve manholes.

4. Set valve on solid bearing.

5. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Fire Hydrants:

1. Provide fire hydrant installations as indicated. Installation shall conform with requirements of the jurisdictional fire department and the water utility owner's standard drawings and specifications.

2. Provide necessary appurtenances and accessories as required to complete the installation.

3. Paint hydrants in accordance with applicable requirements of Section 09 91 00, Painting.

4. Set hydrants plumb, locate pumper nozzle perpendicular to and facing roadway.

D. Thrust Blocks and Harnessing:

1. Provide for counteracting thrust caused by static and dynamic forces, including water hammer at bends, tees, reducers, valves, and dead ends by installing harnessing as indicated or required. For other methods, submit details for approval of the jurisdictional water utility owner prior to use.

2. Provide concrete thrust blocks as indicated where harnessing is not practicable.

E. Water Service Connections: Provide water service connections, where necessary, in accordance with the California Plumbing Code, the installation instructions of the service pipe and fittings manufacturer, and the utility company requirements with reduced pressure back-flow preventer and water meter with by-pass valves.

F. Acceptance Requirements: After installation of pipes, ends of pipes shall be either capped or plugged. No piping shall be buried before being inspected and tested.

3.3 FIELD QUALITY CONTROL

A. Refer to Section 01 43 00 - Quality Assurance, for requirements.

B. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.

C. If tests indicate work does not meet specified requirements, remove such work, replace, and retest at no additional cost to the District.

3.4 TESTS

A. Protection from Flooding: Provide positive measures to protect exposed, installed pipe and compacted pipe bedding from flooding during testing.

B. Notice of Testing:

1. Give 48 hours' notice of intention of testing to the jurisdictional water utility owner, which will furnish, install, and operate pumps, gages, meters, and individual pipe connections to test openings.
2. Designate largest sections feasible for testing and sterilizing. Testing and sterilizing operations shall be performed by the Contractor, at Contractor's expense.

C. Testing Requirements:

1. General:

a. Prior to backfilling, isolate the system by use of approved valves, caps and plugs, or other acceptable methods.

b. Maintain such isolation throughout the performance of leakage and pressure testing.

c. Where valves are used for isolation, eliminate leakage through such valves if it occurs. Maintain new work isolated from existing water mains, except for test connections, until testing and sterilization have been completed.

2. Hydrostatic Tests:

a. For hydrostatic tests, provide approved caps and plugs in sections to be tested, and remove them after testing.

b. Prevent leakage in pipes and fittings at openings. Temporarily block plugged and capped ends to prevent displacement.

c. Install the water source connection for testing the isolated section. The Engineer may permit the use of a tap that will be furnished and installed by utility owner.

d. Provide labor and materials required for leakage testing, including excavation for installation and removal of pumps, gages, meters, and water source connections.

e. Where leakage exceeds the water utility company's standards, perform necessary corrective measures.

f. Remove and replace defective pipes, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

g. Perform hydrostatic tests in accordance with the jurisdictional water utility district's requirements. All such tests shall be witnessed by the jurisdictional water utility district's representative. The Contractor shall be responsible for making all such arrangements.

h. Remove and replace defective pipe, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

D. Testing and Flushing of Potable Water System: Test the potable water system hydrostatically in sections to a pressure of at least 150 psi for not less than 15 minutes, witnessed by the Engineer. Pressure test pipe before burial. Repair leaks and retest the system until the system is leak free. Use testing instruments calibrated by a qualified laboratory in accordance with Section 01 4500 - Quality Control. Test sequence shall be as follows:

1. Lines shall be fully flushed.

2. Lines shall be hydrostatically tested.

3. Lines shall be fully flushed.

4. Lines shall be fully disinfected.

3.5 SYSTEM DISINFECTION

A. Before final acceptance of the water supply system, each section of the new line shall be disinfected in accordance with ANSI/AWWA C651. One of the following sources of disinfectant shall be used:

1. Mixture of water and chlorine gas.

2. Direct application of chlorine.

3. Mixture of water and calcium hypochlorite; or

4. Mixture of water and calcium chloride.

B. Before disinfecting, flush the line thoroughly to remove dirt and extraneous materials. Clean each section of the line between valves independently.

C. Retain the disinfectant solution in the pipe for at least 24 hours. Following this sterilization period, the residual chlorine content at the ends of the section and at other representative points shall be not less than five parts per million. Then, the line shall be drained and thoroughly flushed with water until the residual chlorine content is similar to that obtained from the existing water distribution system.

D. Take water samples and test in accordance with ANSI/AWWA C651.

3.6 CONNECTIONS TO EXISTING MAINS

A. Following testing and sterilization, new water distribution lines shall be connected to existing mains as indicated. Each connection shall be made at a time and in a manner that will result in the least interruption of service.

B. All connections involving shut down of jurisdictional water utility's existing facilities shall be made under the immediate supervision of the jurisdictional water utility district. No member of the Contractor's forces may operate any valve controlling the flow of water in the water utility's existing system.

C. The Contractor shall provide tie-ins to the existing system at a time that is convenient to jurisdictional water utility district, which may be in the evenings and on weekends.

END OF SECTION 33 11 00

SECTION 33 11 13 - WATER LINES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Requirements for installation of both small diameter water lines and large diameter water lines.

1. 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

B. Unit Prices:

1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing, and pipe offset section on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation (open cut and auger) measured along the axis of the pipe and includes all restrained joint fittings and appurtenances.

2. When directed by Owner to install extra fittings, as required to avoid unforeseen obstacles, payment will be based on the following:

a. Extra fittings requested by the Owner and delivered to jobsite will be paid by the Owner.
b. Payment will include and be full compensation for items necessary for installation and operation of water line.

1.3 REFERENCES

C. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.

D. ANSI/NSF Standard 61 - Drinking Water System -Health Components.

E. ASTM A 36 - Standard Specification for Carbon Structural Steel

F. ASTM A 536 - Standard Specification for Ductile Iron Castings

G. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

H. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.
I. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

J. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.

K. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

L. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination.

M. ASTM E 709 - Standard Guide for Magnetic Particle Examination

N. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

O. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

P. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.4 SUBMITTALS

Q. Conform to requirements of Section 01 33 00 - Submittal Procedures.

R. Conform to submittal requirements of applicable Section for type of pipe used.

S. Submit, a minimum of 15 calendar 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 2,000 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 3 - EXECUTION

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. Use adequate surveying methods and equipment; employ personnel competent in us of 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 50 feet on record drawings.

D. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with a unique designation on the inside of pipe. Minimum letter height shall be 4 inches.

E. Laying Large-Diameter Water Main:

1. Lay not more than 200 feet of pipe in trench ahead of backfilling operations.
2. Dig trench proper width as indicated. When operations cause trench width below top of pipe to become 4 feet wider than specified, install higher class pipe or improved bedding, as determined by Engineer. No additional payment will be made for higher class of pipe or improved bedding.

3. Prevent damage to coating when placing backfill. Backfill material shall be free of large rocks or stones, or other material which could damage coatings.
4. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation. Groove pipe to manufacturer's specifications.

F. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes from potable waterline.

G. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from the County before proceeding with construction.

H. Inform Owner if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by the County.

I. Fort Bend County Utility Operations Division will handle, at no cost to Contractor, 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.

J. 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.

K. 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.

L. 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.

3.2 HANDLING, CLEANING AND INSPECTION

M. 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. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

N. 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.

O. 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

P. Conform to applicable provisions of Section 31 23 33.16 Excavation and Backfilling for Utilities.

Q. Bedding: Use bedding materials in conformance with Section 31 23 33.13 Backfill

R. Backfill: Use bank run sand or earth or native soil as specified in Section 31 23 33.13 Backfill. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
S. Place material in uniform layers of prescribed maximum 8-inch loose lifts and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

T. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

U. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the County. 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

V. General Requirements: (*Notify County immediately upon encountering wet conditions!)*

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 County 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.

W. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of the County prior to skipping any portion of Work.

X. 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.

Y. Perform Critical Location as shown on Drawings. Refer to Section 31 23 33.16 Excavation and Backfill for Utilities.

Z. Laying Large Diameter, 24-inch or greater Water Line

1. Lay not more than 200 feet of pipe (unless approved by the County) 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 the County. 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 (Maximum of 3-inch), 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.

AA. 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 County 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 the County 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 the County and the County's Utility Maintenance Division operator is present to observe.
4. Coordinate with County's Utility Department 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 the County.

6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Section 01 11 00 Summary of Work.
7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
8. Submit Lone Star Notification transmittal number to the County 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 prestressed 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 Section 01 33 00 Submittal Procedures.

BB. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water lines. Provide the County a minimum of one week notice prior to shutting down existing water lines. All valves shall be operated by County staff only.

3.6 JOINTS AND JOINTING

CC. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:

1. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
2. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
3. 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.
4. Where preventing movement 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.

5. 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.

DD. 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 prestressing 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. 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.
4. Full length bolt isolating sleeves and washers shall be used with flanged connections.
5. Furnish kits in accordance with Owner's "Approved Products List."

EE. Restrained Joints

1. Restrain pipe joints with Mega lugs or approved equal and concrete thrust blocks. Onsite mixing of concrete shall not be allowed.(Batch mix only).
2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed 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 the County. Make adjustments in thrust restraint lengths at no additional cost to the County.
3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
4. 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.

5. Prevent any lateral movement of thrust restraints throughout pressure testing and operation. Place 3000 psi concrete for blocking at each bend, 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 two days after completion of blocking if Type II cement is used.

FF. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the County.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer
2. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
3. Replace, repair, or reapply coatings and linings as required.
4. Assessment of deflection may be measured by the County at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
5. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

3.7 SECURING, SUPPORTING AND ANCHORING

GG. 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.

HH. 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).

II. 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.

3.8 POLYETHYLENE WRAP

JJ. Double wrap ductile iron pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.

KK. Do not use polyethylene wrap if pipe is cathodically protected.

3.9 CLEANUP AND RESTORATION

LL. Cleanup and restore site as directed by Fort Bend County.

3.10 CLEANING PIPING SYSTEMS

MM. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner must inspect water line for cleanliness prior to filling.

3.11 DISINFECTION OF WATER LINES

NN. Conform to TCEQ requirements for Disinfection of Water Utility Distribution.

3.12 FIELD HYDROSTATIC TESTS

OO. Conform to requirements of Section 33 13 00 Hydrostatic Testing.

END OF SECTION 33 11 13

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 – GENERAL

SECTION INCLUDES

A. Buried Pipe and Fittings

B. Cleanouts

C. Sewage Ejector

D. Field Quality Control

1.1 RELATED SECTIONS

E. Section 01 33 00 - Submittal Procedures

F. Section 01 33 23 - Shop Drawings, Product Data, and Samples

G. Section 01 45 00 – Quality Control

H. Section 01 77 00 – Closeout Procedures

I. Section 01 78 23 – Operation and Maintenance Data

J. Section 01 78 39 – Project Record Documents

K. Section 22 13 01 – Sanitary Sewerage

L. Section 22 14 29 – Water Distribution

M. Section 31 00 00 – Earthwork

N. Section 33 05 16 – Utility Structures

O. Section 33 05 28 – Trenching and Backfilling for Utilities

1.2 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for the site sanitary sewerage system will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for the site sanitary sewerage system indicated in the Bid Schedule of the Bid Form.

B. Lump Sum: If the Bid Schedule indicates a lump sum for the site sanitary sewerage system, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, under Article entitled “Lump-Sum Measurement”.

C. Unit Price: If the Bid Schedule indicates a unit price for the site sanitary sewerage system, the unit-price method of measurement and payment will be as follows:

1. Measurement:

    a. Site sanitary sewerage system will be measured for payment by the linear foot of pipe, installed in place and tested, for each type and size, along the centerline of the pipe, with deductions made for manholes or other structures, measured from the inside face of each structure.

    b. Utility structures will be measured separately for payment as specified in Section 33 05 16 - Utility Structures.

    c. Pipe fittings, joints, pipe bedding, cleanouts, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.

    d. Support of trench excavation, maintenance, support of existing utility facilities, excavation and backfill, concrete, and incidental work pertaining to the installation of sewer pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for sewer pipe.

2. Payment: Site sanitary sewerage system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings

B. American Society for Testing and Materials (ASTM):

1. ASTM A74 Specification for Cast Iron Soil Pipe and Fittings

2. ASTM C12 Practice for Installing Vitrified Clay Pipe Lines

3. ASTM C14 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe

4. ASTM C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

5. ASTM C425 Specification for Compression Joints for Vitrified Clay Pipe and Fittings

6. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets

7. ASTM C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

8. ASTM C700 Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated

9. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

10. ASTM C2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

11. ASTM D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 40

12. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride (PVC) plastic Pipe and Fittings

13. ASTM D2565 Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, Vent Pipe, and Fittings

14. ASTM D2729 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

15. ASTM D2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

16. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

17. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. American Water Works Association (AWWA):

1. ANSI/ Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch AWWA C900 through 12 inches for Water Distribution

D. Sanitary Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional sanitary utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Submit Shop Drawings showing piping layouts, sizes, types, cleanouts, and the sewage structure ejector station.

C. Submit the respective manufacturers' product data for manufactured materials and equipment.

D. Submit equipment manufacturer's printed operating and maintenance instructions in accordance with Section 01 78 23 - Operation and Maintenance Data, consisting of a detailed parts list, a recommended spare parts list, and complete operation and maintenance procedures.

E. Submit certified test reports of equipment, as applicable.

1.5 SUBMITTALS FOR CLOSEOUT

A. Refer to Section 01 77 00 - Closeout Procedures, and Section 01 78 39 - Project Record Documents,

for submittal requirements and procedures.

B. Record actual location of piping mains, valves, connections, thrust restraints, and invert elevations.

1.6 SITE CONDITIONS

A. Excavations shall be dry immediately before and after products are installed. Provide surfaces and structures to, and on which sewerage products will be installed.

B. Coordinate the installation of the sanitary sewerage system with the jurisdictional sanitary district or utility owner.

PART 2 - PRODUCTS

2.1 BURIED PIPE AND FITTINGS

A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated and required. Pipe ends shall be bell and spigot, except plain end pipe shall be joined with mechanical clamp and gasket joint.

B. PVC Pipe and Fittings, 3 Inches and Smaller:

1. Pipe: Polyvinyl chloride (PVC), conforming with ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1, bell and spigot style solvent sealed jointed.

2. Fittings: ASTM D2466, Socket Weld, same material and schedule as pipe.

3. Joints: Socket welded with PVC solvent cement conforming with ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

1. Pipe: AWWA C900, Class 200, Poly (Vinyl Chloride) (PVC) Water Pipe with Bell and Spigot Ends and Flexible Ring Joints.

2. Fittings: ASTM D2466, Type 1, Grade 1, Poly (Vinyl Chloride) (PVC) Fittings, Class 200.

3. Joints: ASTM D3139 gasketed bell joints with ASTM F477 gaskets.

D. Cast Iron Soil Pipe:

1. Pipe: ASTM A74.

2. Joint Devices: ASTM C564 or ANSI A21.11, rubber gasket joint devices, as applicable.

3. Pipe: ASTM C700, unperforated.

4. Joint Device: ASTM C425, compression joint.

E. Concrete Pipe:

1. ASTM C14, Class 3, unreinforced.

2. Joint Device: ASTM C443, rubber compression gasket joint.

F. Reinforced Concrete Pipe:

1. Pipe: ASTM C76, Class III, with steel reinforcement.
2. Joint Device: ASTM C443, rubber compression gasket joint

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G. Pipe Accessories:

1. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, with neoprene ribbed gasket for positive seal.

2. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers traps, and other configurations as indicated or required.

H. Pipe Bedding Material: Clean sand as specified in Section 33 05 28 - Trenching and Backfilling for Utilities.

2.2 CLEANOUTS

A. At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with countersunk slot, and cast-iron frame and cover.

2.3 SEWAGE EJECTOR

A. Provide in accordance with applicable requirements of Section 22 14 29 - Sump Pumps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated.

3.2 PREPARATION

A. Excavations shall be free of water and extraneous material immediately before sanitary sewerage products are installed or placed. Bottoms of trenches shall have a 6-inch sand bed and shall be formed to support the bottom quadrant of the pipe and fittings. Should rock be encountered or should bedding material be unsuitable to support the products at design elevation, continue excavation to an elevation 8 inches below the design elevation and backfill with clean sand.

B. Hand trim excavations to required elevation.
C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling and compacting operations.

D. Interior of pipe, pipe fittings, valves, drains, and cleanouts shall be cleaned of foreign substances before installation.

3.3 INSTALLATION REQUIREMENTS

A. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand-trim bottom of trench to approximately 6 inches below invert of pipe.

B. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.

C. Place sand bedding material meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.

D. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.

E. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.

F. Maintain optimum moisture content of bedding material to attain required compaction density.

G. Install products where indicated. Remove and reinstall products that are disturbed after installation. Ends of products to which future connections will be made shall be either valved, or properly plugged, capped, and anchored.

H. Connections to existing facilities shall be made with fittings and short bends to suit the actual conditions. Connect products in accordance with the product manufacturer's installation instructions.

I. Pipe and fittings shall be set to line and grade before joints are made up. Angular deflections of joints shall not exceed the recommendations of the pipe and fitting manufacturer. Should the alignment require deflection of joints to be in excess of those recommended, use special bends to achieve the indicated deflection. Pipe ends and joints shall be prepared in accordance with the manufacturer's recommendations. As a minimum, pipe ends shall be sanded and cleaned, fittings shall be cleaned, and solvent shall be applied to both pipe and fittings.

J. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321, and the manufacturer’s instructions. Seal joints water tight.

K. Lay pipe to slope gradients as indicated.

L. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches, compacted to 95 percent relative density.

3.4 INSTALLING PIPE

A. Protect pipe and fittings during handling to prevent damage.

B. Place, shape, and compact bedding material to receive barrel of pipe.

C. Start laying pipe at the lowest point; lay true to line and grade indicated.

D. Install pipe to bear on bedding material along its entire length.

E. Do not place the pipe on blocking material of any type.

F. Do not use wedges while installing the pipe.

G. Install pipe so that bells and grooves are on the upstream end.

H. Align each section of pipe with adjoining section leaving a uniform annular space between the bell and spigot to prevent sudden offsets in flow line.

I. As each section of pipe is laid, place sufficient bedding and backfill to hold it firmly in place.

J. Apply lubricant to rubber gasket (O-rings) immediately before joining pipe sections.

K. Keep interior of sewer clean as work progresses. Where small pipe sizes make cleaning difficult, keep a suitable swab and pulling line in the pipe, and pull through each joint immediately after jointing is completed.

L. Keep trenches and excavations dry and free of water during construction and until backfilling and compaction are completed.

M. When work is not in progress, securely plug ends of pipe and fittings to prevent extraneous matter from entering pipes and fittings.

N. Cut pipe ends, which project into a sewer structure, flush with the inside face of the structure and cover exposed pipe reinforcement with grout.

O. Where length of stub is not indicated, install a 4-foot length, and seal the free end with brick masonry bulkhead or an approved stopper.

P. Obtain the Engineer's approval before covering pipe.

Q. Where indicated, place additional bedding material around and over the pipe in lifts not exceeding 6 inches before compaction. Compact each lift before placement of the next lift.

R. Accomplish compaction by methods that will avoid damage to pipe and will not disturb its alignment and grade. The use of vibratory rollers is prohibited until compacted cover over pipe has reached 3 feet or half the pipe diameter; whichever is greater.

S. Connect sanitary sewerage system to existing public sanitary sewers in accordance with requirements of the jurisdictional authority.

3.5 PIPE CLEANOUTS

A. Installation: Cleanouts shall be the same size as the pipe, with 4-inch diameter as a minimum. Cleanouts for drainage pipe shall consist of a longsweep 1/4 bend, or one or two 1/8 bends extended to the location indicated. Wall or accessible piping cleanouts shall be T-pattern, 90degree branch drainage fittings having screw plugs. Cleanouts shall be provided at the base of each riser and shall consist of a wye pattern fitting with a screw plug.

B. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.

C. Establish elevations and invert for inlets and outlets.

D. Mount cleanout surface hub level in grout to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Requirements:

1. Refer to Section 01 45 00 - Quality Control, for field inspection and testing requirements.

2. Where drainage piping is located below invert slabs, conduct a ball, shuttlecock, or mandrel test to ensure that the line is free of obstructions subsequent to the placing of pervious backfill

material over the line and prior to the placement of the concrete invert slab.

3. Upon completion of the test and determination that the line is free of obstructions, plug, cap, or otherwise close the open end or ends of the installed piping to prevent the entrance of debris into the lines.

4. Immediately prior to final inspection of the work, remove debris from manholes, drain inlets, and floor scupper drains. In the presence of the jurisdictional sanitary utility owner's representative prove by one of the methods specified above that the piping is free of obstructions.

5. The Contractor shall be responsible for making all necessary arrangements with the jurisdictional sanitary utility owner for performing and witnessing the required tests.

6. Request inspection of exposed piping prior to placing backfill.

7. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.

8. If tests indicate work does not meet requirements, remove such work, replace, and retest at no additional cost to the District.

B. Sanitary Pipeline Tests:

1. Perform air tests on all installed sanitary sewer pipes upon completion of backfill.

2. Hydrostatically test all installed sanitary sewer force mains.

3. Test all manholes for infiltration or exfiltration.

4. Test pipe sections by the exfiltration test.

5. Test sewer 24 inches or less in diameter with low pressure.

6. Sewers with a diameter greater than 24 inches may be tested by visual inspection.

C. Exfiltration Test:

1. Tightly plug end of pipe at downstream manhole.

2. Fill sewer, at either upstream manhole or standpipe, with water.

3. Allow water to stand for not less than eight hours, and until pipe has become saturated. Refill manhole or pipe to measuring mark and begin test.

4. Exfiltration will be determined as follows:

a. If standpipe has been filled, maintain a head of water not less than 2 feet nor more than 15 feet above highest point in the line being tested.

1) Exfiltration: that volume of water added to standpipe during a 20-hour period.

b. If upstream manhole has been filled, measure original water elevation and, after 20 hours, final water elevation. Convert difference in elevation to gallons. Head of

water shall be not less than 2 feet above highest point in the line being tested or not less than 2 feet above existing groundwater table, whichever is greater.

1) Exfiltration: that volume of water calculated from the difference in elevations during a 20-hour period.

5. Allowable leakage:

a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.

b. If leakage exceeds permissible loss, sewer section will not be accepted.

c. Do not conduct another exfiltration test until conditions of groundwater surrounding pipe return to a condition similar to those existing at beginning of test period.

D. Infiltration Test:

1. Tightly plug end of pipe at upstream manhole.

2. Install a 90-degree notch weir in downstream manhole.

3. Allow water to accumulate behind weir until overflow is constant.

4. Allowable leakage:

a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.

b. If measured infiltration is more than the allowable rate, sewer section will not be accepted.

E. Low-Pressure Air Test:

1. Clean and set sections of pipe to be tested before starting air test.

2. Plug pipe outlets with pneumatic plugs capable of resisting internal testing pressures without requiring external bracing.

3. Immediately following pipe cleaning and wetting, slowly supply air to plugged pipe until internal air pressure reaches 4 psi. Allow at least two minutes for temperature to stabilize before proceeding, except slowly add air to maintain a 3.5 psig to 4 psig pressure. While temperature is stabilizing, spray plugs, pipes, and hoses with soap solution and eliminate air leaks.

4. After temperature has stabilized, measure time required for pressure to drop from 3.5 psig to 2.5 psig. If measured time exceeds allowable time, pipe will not be accepted.

5. Time, in seconds, for pressure to drop from 3.5 to 2.5 psig shall be not less than the following: time for intermediate lengths shall be interpolated:

Length of Pipe Diameter in Inches

Pipe (Ft)	8	10	12	15	18	21	24

25	18	28	40	62	89	121	158
50	35	55	79	126	178	243	317
75	53	83	119	186	267	364	475
100	70	110	158	248	356	485	634
125	83	38	198	309	444	595	680
150	100	165	238	375	510	595	680
175	123	193	277	425	510	595	680
200	141	120	317	425	510	595	680
225	158	248	340	425	510	595	680
250	176	275	340	425	510	595	680

F. Visual Test Method: Slowly pull a television camera through sewer and inspect for visual leaks and cracks in pipe. Repair leaks, then re-inspect pipe.

G. Joint Pressure Testing:

1. Insert sealing packer with joint testing capability, into sewer line.

2. Place sealing packer around joint and pressure test joint. If a drop in air pressure occurs, reseal the joint.

3. Repeat procedure for each joint.

H. Criteria for Acceptance: The section of sewer being tested will not be accepted if test results exceed allowable leakage or take less time than minimum holding time. If pipe proves to be unacceptable, immediately repair defective materials and installation. The Contractor will not be permitted to change to another test if original test method reveals system has failed.

I. Obstruction Tests:

1. Perform field tests to verify that installed sanitary systems are free from obstructions.

2. Remove obstructions by excavating at the apparent obstruction and repairing or replacing the defective pipe.

END OF SECTION 33 31 00

SECTION 33 41 00 - STORM SEWAGE SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing storm sewers and appurtenant structures.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. AASHTO: American Association of State Highway and Transportation Officials

   a. M 36: Specification for Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

   b. M 190: Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

   c. M 252: Specification for Corrugated Polyethylene Drainage Tubing.

   d. M 294: Specification for Corrugated Polyethylene Pipe 12 inch to 36-inch diameter.

2. ASTM: American Society for Testing and Materials

   a. A 48: Specification for Gray Iron Castings.

   b. A 74: Specification for Cast Iron Soil Pipe and Fittings.

   c. C 40: Test Method for Organic Impurities in Fine Aggregate for Concrete.

   d. C 76: Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

   e. C 150: Specification for Portland Cement.

   f. C 443: Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.

   g. C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

   h. D 618: Conditioning Plastics and Electrical Insulating Materials for Testing.

   i. D 1248: Polyethylene Plastics Molding and Extrusion Material.

   j. D 1693: Environmental Stress Cracking of Ethylene Plastics.

   k. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

   l. D 2239: Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on

Controlled Inside Diameter.

m. D 2412: Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

o. D 2447: Specifications for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

p. D 2466: Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

q. D 2467: Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

r. D 2564: Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

s. D 2665: Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

t. D 2729: Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

u. D 2855: Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

v. D 3035: Specifications for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

w. D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

x. D 3261: Specification for Butt Heat Fusion of Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

y. D 3350: Specification for Polyethylene Plastics Pipe and Fittings Material.

z. F 402: Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings.

aa. F405: Specification for Corrugated Polyethylene (PE) Tubing and Fittings.

bb. F 412: Standard Terminology Relating to Plastic Piping Systems.

cc. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

dd. F 656: Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Pipes and Fittings.

ee. F 714: Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

ff. F 913: Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

gg. F 667: Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.

3. Federal Specification
    a. SS-S-210A and Latest Amendments: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

1.3 SUBMITTALS

A. In accordance with Section 013300 – Submittal Procedures of these Specifications, the following shall be submitted:

1. Certificates

    a. Manufacturer's certificates and load tickets stating that materials meet specified requirements.

2. Shop Drawings

    a. Shop Drawings and details of all storm sewers and drains, including relationship to other systems and true position and details of all interfaces, connections, inlets, clean- outs, manholes, alignment and grade, changes of direction, offsets, bedding and protection, materials, manufacturer's installation and connection instructions and recommendations, and all other pertinent data.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products for use within Fort Bend County right-of-way shall meet the applicable requirements.

2.2 PIPES AND FITTINGS

A. Reinforced Concrete Pipe (RCP)

1. ASTM C 76, bell-and-spigot, Class III, Wall B.

B. Corrugated Galvanized Metal Pipe (CGMP)

1. AASHTO M 36, coated and paved in accordance with AASHTO M 190, Type C coating for pipe and Type A coating for coupling bands.

C. PVC Pipe in accordance with the following:

1. ASTM D 1785.

2. ASTM D 2241.

3. ASTM D 2466.

4. ASTM D 2467.

D. PE Pipe

1. ASTM D 2447.
2. ASTM D 3035.
3. ASTM D 3350 Type PE 3408.
4. ASTM F 714 Type PE 3408.

2.3 JOINTS

A. Gaskets for RCP in accordance with the following:

1. Federal Specification SS-S-210A.
2. ASTM C 443.

B. All joints in PVC plastic pipe shall be solvent cemented in accordance with the following:

1. ASTM D 2564.
2. ASTM D 2672.
3. ASTM D 2855.
4. ASTM F 402.
5. ASTM F 656.

C. All joints in PE plastic pipe shall be fusion butt-welded in accordance with ASTM 3261.

2.4 DRAINAGE STRUCTURES

A. Manhole

Type as indicated on the Drawings and conforming to applicable Standards for Fort Bend County Right-of-Way. Frame and Cover ASTM A 48 Class 35 B.

B. Inlet

Type as indicated on the Drawings and conforming to applicable Standards in Fort Bend County Right-of-Way. Frame and Grate ASTM A 48 Class 35 B.

C. Reinforcing Steel

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Cast-in-Place Concrete (Class 3000)

As specified in Section 321373.19 - Cast-in-Place Concrete of these Specifications.

E. Mortar (Type M)

2.5 CEMENT-STABILIZED SAND BACKFILL

A. Aggregate

Use clean sand; deleterious materials in the sand shall not exceed the following limitations, by weight:

Material removed by denatation	5.0 percent
Clay lumps	0.5 percent
Other deleterious substances such as coal, shale, coated grains of soft flaky particles.	2.0 percent

Gradation Requirements:

Retained on 3/8-in. sieve	0 percent
Retained on 1/4-in. sieve	0 - 5 percent
Retained on 20-mesh sieve	15 - 50 percent
Retained on 100-mesh sieve	80 - 100 percent

Color test per ASTM C 40, color not darker than standard color.

B. Cement

ASTM C 150, Type I or II.

C. Water

Potable, from municipal supplies approved by the State or County Health Department.

D. Mixture

Use at least 1-1/2 sacks of cement per cubic yard of mixture. Use amount of water required to provide mix suitable for mechanical hand tamping and mix in approved mixer. Stamp load tickets at plant with time of loading. Material not in place within 1-1/2 hours after loading or that has obtained an initial set will be rejected and shall be removed from the Site and replaced with new acceptable mixtures at no additional cost to OWNER.

2.6 TIMBER POSTS

A. Southern Pine or Douglas Fir, pressure-treated in accordance with American Wood Preservers' Association (AWPA) Standards.

PART 3 - EXECUTION

3.1 GENERAL

A. All storm sewer work performed within Houston right-of-way shall meet the applicable requirements.

3.2 EXCAVATION

A. All excavation shall be in accordance with Section 017330 - Trench Safety Systems of these Specifications.

B. Perform excavation for storm sewer and storm sewer drainage structures to line and grade

required as shown on the Drawings and as specified herein.

C. If the excavation exceeds the permissible dimensions, extend the encasement or install pipe of higher strength, as directed.

D. Prevent surface or ground water from flowing into excavation. Install, operate, and maintain dewatering system to convey water away from excavation. Notify the Engineer in writing of delays to the Work caused by water intrusion.

3.3 PIPE ENCASEMENT

A. Place cement-stabilized sand bedding before laying pipe. Bedding shall be compacted and shaped to fully support the pipe.

B. After the pipe is laid, place cement-stabilized sand beside and above the pipe in 4 in. lifts to the limits shown on the construction drawings. Compact individual lifts with a hand-operated, motorized tamper; exercise care to avoid damaging the pipe.

3.4 LAYING PIPE

A. Install and joint pipe in accordance with the pipe manufacturer's instructions and as specified herein.

B. Provide a minimum of 6 in. clearance between storm sewer and sanitary sewer.

C. Seal open end of pipe with plug when pipe laying operation is temporarily halted. Plug shall remain in place until operation restarts.

3.5 BACKFILL

A. On completion of construction, backfill the excavation as specified in Section 312300 – Excavation, Grading, and Fill of these Specifications and in accordance with details on the construction drawings. Backfill only when the written approval of the Engineer is obtained to do so.

3.6 CONSTRUCTION OF MANHOLES AND INLETS

A. General

1. Construct manholes and inlets as soon as practical after sewer lines into or through the manhole or inlet locations are completed.

2. Construct manholes and inlets at locations and of the type indicated. All manholes within 9 feet of existing water lines shall be watertight.

B. Manholes

1. Provide base of the shape and size required with a minimum thickness of 12 inches.
2. Place axis of manholes directly over the centerlines of the lines, unless otherwise indicated.

3. Shall be constructed of either precast or cast-in-place concrete.

C. Inlets

1. Shall be constructed of either precast or cast-in-place concrete.

3.7 CLEANUP

A. Remove temporary structures, rubbish, waste materials, and excess excavated materials from the Site and dispose of legally.

END OF SECTION 33 41 00